

FORT JACKSON

LAND DISTURBANCE HANDBOOK



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Prepared for Fort Jackson Directorate Public Works – Environmental Division (DPW-ENV) in accordance with South Carolina Regulations and the USEPA NPDES Stormwater Program

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Acronyms

| | |
|--------|--|
| BMP | Best Management Practices |
| BSDP | Best Site Design Practices |
| CWA | Clean Water Act |
| ECB | Erosion Control Blankets |
| EPSC | Erosion Prevention and Sediment Control |
| FEMA | Federal Emergency management Agency |
| LID | Low Impact Development |
| MEP | Maximum Extent Possible |
| MOI | Memorandum of Instruction |
| MS4 | Municipal Separate Storm Sewer System |
| NOI | Notice of Intent |
| NOV | Notice of Violation |
| NOW | Notice of Work |
| NPDES | National Pollutant Discharge Elimination System |
| PCA | Pollution Control Act (South Carolina 1970) |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SMSRA | Stormwater Management and Sediment Reduction Act (South Carolina 1991) |
| SPP | Spill Prevention Plan |
| SWPPP | Stormwater Pollution Prevention Plan |
| TRM | Turf Reinforced Mat |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |

EXECUTIVE SUMMARY

Purpose

The purpose of the Fort Jackson Land Disturbance Handbook (Handbook) is to educate potential engineers, architects, contractors and any others in the manner in which land development activities will be conducted. The main focus of the Handbook is the proper control of runoff in terms of quantity and quality. Details of the submittal and permitting process are also provided.

Need for the Handbook

The Handbook will provide consistency in plan submittals that are part of any land disturbance activity as well as address some of the issue that Fort Jackson faces under the NPDES General Permit SCS0000000 requirements. Fort Jackson has obtained the equivalent of delegated review responsibilities from SCDHEC for land disturbance activities, and this Handbook will assist reviewers and planners for Fort Jackson with the design that will simplify the process for complying with the NPDES permit and ensuring the protection of lands.

Organization

This Handbook is sectioned into the following chapters:

Chapter 1 – Introduction: Covers the broad perspective on why and how this Handbook was created. Details on the history of the NPDES program and compliance issues are discussed.

Chapter 2 – Stormwater Permitting Procedures: Lists all of the requirements that are to be in any submittal package for land disturbance activities and the submittal process.

Chapter 3 – Design Standards: Provides the design standards and the types of information that Fort Jackson requires in any submittal package for land disturbance activities. These include design specifics for storm sewer, erosion control, BMPs, culverts, detention ponds, or other structural portions of the drainage system.

Chapter 4 – Inspection and Enforcement Procedures: Defines the necessary inspection and reporting requirements for construction and post construction projects. It also details the enforcement measures available when a construction site is not in compliance.

Chapter 5 – References: Lists all references used or mentioned in the Handbook. These include documents that provide greater detail on methodologies, the NPDES program, BMPs design, and many others.

Limitations

This Handbook was not intended to be a single source document for performing the required civil engineering calculations that will be necessary to comply with the land disturbance requirements of Fort Jackson. Instead, the information will provide many of the inputs required for those calculations. The reason for this approach was to simplify the process. For example, including information on how to calculate a peak flow, which is fully documented and available, is redundant and inefficient. The Reference section provides links to this and many other types of information.



1.0 INTRODUCTION

1.1 Purpose of the Handbook

The purpose of the Fort Jackson Land Disturbance Handbook (Handbook) is to provide engineers, plan reviewers, inspectors, and contractors involved in land development within the boundaries of the United States Army Basic Training Facility at Fort Jackson with the following information:

- Land disturbance requirements;
- Stormwater management requirements;
- Summarization of the permit application submittal requirements and approval process; and
- Guidelines for designing, implementing, and maintaining stormwater best management practices (BMPs) and low-impact development (LID) techniques to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to increased flow volumes and peak discharge rates from developed areas;

This Handbook has been prepared in accordance with NPDES Phase II General Permit No. SCS0000000 and the South Carolina Stormwater Management and Sediment Reduction Act to accomplish the following objectives:

- Reduce stormwater impacts on water quality;
- Reduce stormwater impacts on water quantity;
- Protect downstream areas from adverse stormwater impacts resulting from development;
- Identification of required content for and format of stormwater plan submittals and plan reviews; and
- Submittal of high quality stormwater design plans from the design community.

This Handbook has been prepared under the direction of Fort Jackson, which has been granted the authority to administer the stormwater management and sediment control plan review, approval/disapproval, and inspection by South Carolina Department of Health and Environmental Control (SCDHEC). By satisfying the requirements outlined in this Handbook,



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the resulting design is considered to be in compliance with the provisions of the Stormwater Management and Sediment Reduction Act of 1991.

1.2 Description and Use of the Handbook

The scope of this Handbook is limited to the requirements related to stormwater management as reviewed and approved by the Fort Jackson Directorate of Public Works. This Handbook is not intended as a textbook or a comprehensive engineering design reference. It was instead developed under the assumption that the user possesses a basic understanding of stormwater control design, construction, or land development depending on the user's particular area of expertise. References to guidance documents from federal, state, and local agencies, as well as commercial products are given throughout this Handbook to provide additional information to users. Two common examples are the Natural Resources Conservation Service's (NRCS) TR-55 and SCDHEC's Best Management Practices (BMP) Manual.

The design standards are not intended to restrain or inhibit engineering creativity, freedom of design, or the need for engineering judgment. When shown to be applicable, it is encouraged that new methods, techniques, and innovative stormwater BMPs be submitted with supporting documentation. However, the use of such approaches should be substantiated with submitted documentation by design professionals showing that the proposed design is equal to, or exceeds the traditional procedures in terms of performance and economic feasibility.

On projects that require site specific designs pertaining to stormwater management and water quality, site plans, details, calculations, construction specifications, and other technical documents must be designed and sealed by a professional engineer, landscape architect, or Tier B Land Surveyor that is registered in the State of South Carolina, with sufficient knowledge and experience to accomplish all design elements of the site plan. Users who are not justly qualified by education or experience in the fields of stormwater control design, construction, or land development should consult with a qualified professional in one or more of these areas prior to planning for construction activities.

1.3 Design Handbook Organization

The Handbook contains five chapters, organized to present recommended technical and engineering procedures along with criteria obtained from local, state, and federal requirements; including compliance with the State of South Carolina's Stormwater Management and Sediment Reduction Act and NPDES Permit No. SCS000000. A general Table of Contents is found at the beginning of the Handbook. Each chapter of the Handbook presents information on each aspect of stormwater management that could be encountered during land disturbance activities.



1.4 Updates to the Design Handbook

This Handbook is intended to be a dynamic document. As design technology and criteria evolve, the Handbook will be updated.

1.5 The Need for Stormwater Management

Development has the potential to alter the natural drainage patterns and flow rates and volumes of water in the environment. Development changes the physical, chemical, and biological conditions of natural waterways. When land is developed, the natural hydrology of the watershed is disrupted and traditional systems have facilitated the efficient removal of not just runoff, but associated pollutants into receiving waters. Clearing removes vegetation that intercepts and slows rainfall runoff. Grading removes beneficial topsoil, compacts the subsoil, and fills in depressions that provide natural underground storage. As a result of land development, infiltration is decreased and rainfall that once seeped into the ground runs off the surface at an accelerated rate.

1.5.1 Effects of Development on Watershed Hydrology

Development and urbanization have the following impacts on receiving waterbodies:

- Changes to Stream Flow
 - Increased runoff volumes
 - Increased peak runoff discharges
 - Greater runoff velocities
 - Increased flooding frequency
 - Lower dry weather flows (base flow)
- Changes to Stream Geometry
 - Stream channel enlargement and erosion
 - Stream downcutting
 - Changes in channel bed due to sedimentation
 - Increase in floodplain elevation
- Degradation of Aquatic Habitat
 - Degradation of habitat structure



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- Decline in stream biological functions
- Water Quality Impacts
 - Reduced oxygen in streams
 - Microbial contamination
 - Hydrocarbons and toxic materials
 - Sedimentation
- Property Damage and Safety Concerns
- Unsightly Aesthetic Stream Channel Conditions

1.5.2 Innovative Design Approach

When designing for land disturbance activities, the design should consist of five categories: maximum water quantity (flood control), design storm rainfall depth and/or intensity (design conditions), erosion prevention, sediment control, and water quality benefits. If an innovative stormwater design approach is to be used, the design professional should take the following considerations in mind:

- Stormwater quantity and quality are best controlled at the source of the problem by reducing the potential maximum amount of runoff and pollutants; and
- Best site design techniques implement stormwater management by using simple, nonstructural methods along with or in place of traditional stormwater management structures when applicable.
- Equaling or exceeding traditional stormwater management designs in terms of performance (rate/volume attenuation, pollutant removal) and economic feasibility (long-term) are essential to a proposed concept's eventual approval.

Innovative approaches to site design are more of a source control for stormwater runoff – the site design practices limit the amount of runoff generated as well as use certain BMPs within the design. These types of design concepts are described in detail in several sources including: **Georgia Stormwater Handbook, Volume 1: Policy Guidebook**, First Edition, Atlanta Regional Commission, August 2001; and, **Low-Impact Development Design Handbook**, Prince George's County Maryland (1999a, 1999b). Some general concepts from these sources are provided in the following Sections.



1.5.3 Best Site Design Practices and Site Planning Process

The first step in addressing stormwater management begins in the site planning and design stage of the development project. By implementing Best Site Design Practices (BSDPs) during the site planning process, the amount of runoff and pollutants generated from a site can be reduced by minimizing the amount of impervious area and utilizing natural on-site treatments. The minimizing of adverse stormwater runoff impacts by the use of BSDPs and site planning should be a major consideration for a design professional.

The reduction of runoff volumes and stormwater pollutants reduces the total number and size of stormwater management controls that must be implemented under the guidelines set forth in this Handbook. BSDPs reduce the amount of total post-development impervious areas and maintain natural characteristics of the pre-development site conditions. Therefore, the post-development curve number and time of concentrations are maintained more closely to the pre-development conditions. This reduces the overall hydrologic and hydraulic impact of the development.

1.5.3.1 Maintaining Site Resources and Natural Undisturbed Areas

Conservation of site resources and natural undisturbed areas helps to reduce the post development runoff volume and provide areas for natural stormwater management. Some natural site resources that should be maintained include, but are not limited to:

- Natural drainageways,
- Vegetated buffer areas along natural waterways,
- Floodplains,
- Areas of undisturbed vegetation,
- Low areas within the site terrain,
- Natural forested infiltration areas, and
- Wetlands.

1.5.3.2 Lower Impact Site Layout Techniques

Lower impact site layout techniques involve identifying and analyzing the location and configuration of structures on the site to be developed. Where applicable, the following options that create lower impacts layouts should be used:

- Fit the design layout to follow the natural contours of the site to minimize clearing and grading and preserve natural drainage ways and patterns.



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- Limit the amount of clearing and grading by identifying the smallest possible area on the site that would require land disturbance.
- Place development areas on the least sensitive areas of the site.
- Utilize nontraditional designs to reduce the overall imperviousness of the site by providing more undisturbed open space by minimizing clear-cutting.

1.5.3.3 Reduction of Impervious Cover

The reduction of total impervious area directly relates to a reduction in stormwater runoff volume and the associated pollutants from a development site. The amount of impervious cover on a site can be reduced by the following techniques where applicable:

- Reduce building footprints by requiring some buildings to be multi-story.
- Reduce parking lot areas and/or the use of porous paver surfaces for desired overflow parking.
- Increase the amount of vegetated parking lot “islands” that can also be utilized for stormwater management practices such as Bioretention areas.

1.5.3.4 Utilization of Natural Features for Stormwater Management

Traditional stormwater drainage design does not utilize the natural drainage patterns of the site from the pre-developed state. Structural stormwater drainage controls are traditionally designed to quickly remove stormwater runoff from the site without utilizing any of the natural storage areas. These natural drainage areas should be considered as potential stormwater drainage systems. These natural areas can be utilized in the following ways where applicable:

- Vegetated buffers and undisturbed areas on the site are useful to control sheet flow (not concentrated flows) by providing infiltration, runoff velocity reduction, and pollutant removal.
- Various natural drainageways should be maintained and not disturbed to provide a natural stormwater drainage system to carry runoff to a natural outlet. The use of natural drainageways allows for more storage of stormwater runoff, lower peak flow rates, a reduction in erosive runoff velocities, and the capture and treatment of pollutants.
- Use vegetated swales instead of curb and gutter applications where applicable. This application allows for more storage of stormwater runoff, lower peak flow rates, a reduction in erosive runoff velocities, and the capture and treatment of pollutants which does not occur with curb and gutter systems.



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- Where ditched roadways are not practicable, curb and gutter systems may be combined with vegetated swales at outfalls to provide added water quality benefits versus the traditional piped outfall designs.
- When applicable, direct rooftop runoff to pervious natural areas for water quality treatment and infiltration instead of connecting rooftop drains to roadways and other structural stormwater conveyance systems.

1.5.3.5 Engineered/Proprietary Devices

Fort Jackson is aware of the potential benefit in using a number of engineered devices currently available on the market, such as treatment devices such as baffle boxes, cartridge filters, bioretention, erosion control devices such as socks and tubes, and advanced vegetation producing methodologies. Fort Jackson will evaluate any and all such devices specified for a given product and require for each appropriate drawings, specifications, and discussions as to the applicability of the product, expected performance, and required maintenance. Fort Jackson reserves the right to request that certain devices be installed.

1.6 Stormwater Management Regulations and Policies

To address the adverse impacts of urbanization and land development, Federal, State and Local regulations have been adopted to protect the quantity and quality of the runoff received by the natural receiving waterbodies.

1.6.1 Stormwater Related Regulations and Permits

With the mandate of the Clean Water Act, the United States Environmental Protection Agency (USEPA) stated that it is illegal to discharge any pollutant to the “Waters of the United States” without a NPDES Permit. The various types of NPDES stormwater permits are described below.

1.6.1.1 Clean Water Act

The Federal Clean Water Act (CWA) requires that discharge permits, called National Discharge Elimination System (NPDES) permits, be obtained for every point source discharge of wastewater. The 1987 amendments to the CWA also required NPDES permits for industrial discharges, including stormwater runoff associated with land disturbing activity (typically land development and construction) of five (5) acres or greater. The threshold five-acre area was challenged and the federal NPDES regulations were amended in accordance with a court order for stormwater discharges in December 1999. These amendments lower the acreage for when an NPDES permit is required for construction or land clearing to one (1) acre while allowing a case-by-case determination for sites less than one (1) acre.

The 1987 CWA Amendments also require NPDES permitting for stormwater runoff from urbanized areas. A municipal separate storm sewer system (MS4) NPDES permit is required



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based on population. MS4s are divided into three categories: large (250,000 or greater); medium (less than 250,000 but equal to or greater than 100,000); and small (greater than 50,000). The implementation schedule for these MS4 permits has been repeatedly delayed. All permits are now in the process of being implemented.

For both the land disturbing and MS4 non-point source permits, preventing the pollution at the source through the use of Best Management Practices (BMPs) is the preferred and most practical method. Additional BMPs can be used as needed to address capture, control, and treatment of pollutants after they have been generated or released from a source area. Authority to administer the NPDES permit program was delegated to SCDHEC in accordance with the CWA by the USEPA.

1.6.1.2 South Carolina Pollution Control Act

The South Carolina Pollution Control Act (PCA) S.C. was originally enacted in 1950 and was last amended in 1970 during the initial stages of the environmental movement. It was written very broadly and is applicable to essentially any activity.

The most important provision of the statute is Section 48-1-90, it states that it is “unlawful for any person, directly or indirectly, to throw, drain, run, allow to seep or otherwise discharge into the environment...[any] wastes, except as in compliance with a permit” issued by SCDHEC.

1.6.1.3 South Carolina Stormwater Management and Sediment Reduction Act

The South Carolina Stormwater Management and Sediment Reduction Act of 1991 (SMSRA) S.C. Code Ann. §§ 48-14-10 et seq. was enacted to address the increase in stormwater runoff rate and quantity, the decrease of rainwater infiltration, and the increase in erosion associated with the extensive urban development that has been occurring throughout the state. Fort Jackson has the authority to implement the requirements of this Act and its associated regulations.

1.6.1.4 NPDES Permit for Stormwater Discharges Associated with Industrial Activity

All stormwater runoff from “industrial activities” is considered an illegal discharge without an NPDES Stormwater Permit (SCR100000). These permits require certain industries to develop and implement a Stormwater Pollution Prevention Plan (SWPPP), which must include appropriate BMPs to minimize pollution to the receiving natural waterbodies. There are two general types of industrial activity permits: “construction related” and “other”. A NPDES stormwater permit for stormwater discharges from construction sites is required for all construction sites that disturb one (1) or more acres of land. The requirements for obtaining and complying with this type of permit are covered within this Handbook.



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1.6.1.5 NPDES MS4 General Permit SCR300000

Fort Jackson is required to comply with the NPDES General Permit for stormwater discharges. This permit was issued by SCDHEC in accordance with the provisions of the Stormwater Management and Sediment Reduction Act of South Carolina (S.C. Code Sections 48-14-10 et seq., 1976) and with the United States Clean Water Act (P.L. 92-500), as amended, 33 U.S.C. Section 1251 et seq. The Memorandum of Instruction (MOI) defines compliance of this permit. The permit requires that Fort Jackson develop and implement a Stormwater Management Program (SWMP) to control the discharge of pollutants from its MS4 to the maximum extent practicable (MEP).

Fort Jackson has been granted the authority to administer the stormwater management and sediment control plan review and approval/disapproval, and the inspections during construction and maintenance inspection components of the South Carolina Stormwater Management and Sediment Reduction Program to handle the following responsibilities:

- Comply with all Federal and State regulatory requirements imposed by the NPDES Permit in accordance with the Clean Water Act to manage stormwater discharges from Fort Jackson.
- Conduct all activities necessary to carry out the stormwater management programs and other requirements included in the NPDES General Permit, SCS0000000.
- Maintain the stormwater system consistent with provisions of NPDES General Permit, and pursue the necessary means and resources required to fulfilling this responsibility.
- Direct and oversee the continuous implementation and direct and ensure compliance with the NPDES General Permit.

1.7 Contact Information

The following Fort Jackson personnel should be contacted for any questions, clarifications, or other information not in this handbook.

Primary Contact:

Matt Holstein
Stormwater Contractor
2563 Essayons Way
Fort Jackson, SC 29207
(803) 751-9504
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1.8 Fees

Currently, Fort Jackson does not require any plan review or inspection fees. However, in the event that SCDHEC decides to do a plan review or inspection of the project, standard DHEC fees will apply. SCDHEC does charge a fee for submittal of an NOI for projects disturbing areas over one acre. At the time of issuance of this handbook, the fee was \$125. This Handbook does not excuse any fees charged by any other agency.

1.9 Definitions

The Directorate of Public Works shall have the right to define or interpret any other word or term contained within this Manual. The rules of verbal construction found in the Stormwater Management Ordinance apply to this Handbook.

1. Culvert: any structure not classified as a bridge which provides an opening under any roadway, including pipe culverts, and any structure so named in the plans.
2. Contour: an imaginary line, or its representation on a contour (topographic) map, joining points of equal elevation.
3. Detention: the collection and storage of stormwater runoff in a surface or sub-surface facility for subsequent controlled discharge to a watercourse or water body.
4. Development: the act of any person, or others who acts in his own behalf, that is required to submit an application for approval to disturb land or encroachment or site construction and is thereafter responsible for maintaining compliance with this Handbook and conditions of the approved application.
5. Ditch: a drainage channel in earth created by natural or artificial means to convey surface and/or subsurface water, flowing continuously or intermittently.
6. Drainage: a general term applied to the removal of surface or subsurface water from a given area either by gravity via natural means or by systems constructed so to remove water, and is commonly applied herein to surface water.
7. Elevation: height in feet above a given known datum, such as mean sea level.
8. Embankment or Fill: a deposit of soil, rock or other material placed by man.
9. EPSC: Erosion Prevention Sediment Control
10. Grading: any displacement of soil by stripping, excavating, filling, stockpiling, or any combination thereof, including the land in its excavated or filled state.



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11. **Impervious Surface:** a surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water. The term includes most conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar structures.
12. **Mean Sea Level (MSL):** the average (mean) height of the sea or ocean, in reference to NAVD29 or NAVD88.
13. **Outlet Facility:** stormwater management facility designed to regulate the elevation, rate, and volume of stormwater discharge from detention facilities.
14. **Owner/Operator:** means the property owner, or any person who acts in his own behalf, that submits an application for approval to disturb land or vegetation or for encroachment, and the person, if so designated by default or on legal documents, as the responsible party for maintenance of a stormwater system(s) and facility(s). May be referred to as owner, owner/operator or agent. Certification signatures must be provided by this person.
15. **Post-Development Conditions:** those conditions which are expected to exist, or do exist, after alteration, of the natural topography, vegetation, and rate, volume or direction of stormwater runoff, (resulting from development activity).
16. **Pre-Development Conditions:** those conditions, in terms of the existing topography, vegetation and rate, volume or direction of stormwater runoff, which exist at the time the applicant submits an application form for a land disturbance permit or waiver.
17. **Project:** improvements and structures proposed by the applicant to be constructed on a defined site as part of a common plan of development.
18. **Directorate of Public Works:** means the director of the Directorate of Public Works of Fort Jackson, South Carolina or an authorized representative or designee.
19. **Rate:** volume of water passing a point per unit of times, generally expressed in cubic feet per second (cfs).
20. **Redevelopment:** See Development.
21. **Retention:** the collection and storage of stormwater runoff without subsequent discharge to surface waters.
22. **Retrofit:** the process of altering an existing drainage system to function properly or more efficiently that currently exists. Retrofitting will be a common method used by



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Fort Jackson to address TMDLs (retrofitting systems to include a water quality/runoff treatment device).

23. **Runoff:** that part of rainfall that is not absorbed into the sites but flows over the site as surface waters.
24. **Sediment:** fine, particulate material, whether mineral or organic, that is in suspension and is being transported, or has been transported, from its site of origin by water or air.
25. **Sedimentation:** the process which operates at or near the surface of the ground, or deposits soils, debris and other materials either on other ground surfaces or in the waterbody.
26. **Sedimentation Facility:** any structure or area which is designed to retain suspended sediments from collected stormwater runoff, to include sediment basins.
27. **Site:** any tract, lot, or parcel of land or combination of tracts, lots, or parcels of land which are in common ownership, or are contiguous and in diverse ownership where development is to be performed as part of a unit, subdivision, or project.
28. **Site Construction:** is considered the act or process of altering the natural cover or topography and alters the quality or quantity of stormwater runoff.
29. **Special Protection Areas:** designated areas within Fort Jackson within which more stringent design standards have been established to address an existing problem, such as flooding or water quality. Construction activities occurring within these areas will be required to comply with the additional or more stringent design criteria.
30. **Storm Frequency:** rate of likely recurrence of a rainstorm.
31. **Stormwater Pollution Prevention Plan (SWPPP):** the plan to manage stormwater in terms of collection, conveyance, storage, treatment and disposal of stormwater runoff in a manner to meet the objectives of this Handbook and its terms, including, but not limited to, measures that control the increased volume and rate of stormwater runoff and water quality impacts caused by man-made changes to the land. This plan is approved as detailed in this document and includes the engineering calculations and construction drawings.
32. **Subdivision:** all divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, whether immediate or future, of sale, lease, or building development, and includes all division of land involving a new street or change in existing streets, and includes re-subdivision which would involve the further division or relocation of lot lines of any lot or lots within a subdivision



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previously made and approved or recorded according to law; or, the alteration of any streets or the establishment of any new streets within any subdivision previously made and approved or recorded according to law, and includes combination of lots of record.

- 33. Vegetation: all plant growth, especially trees, shrubs, mosses, and grasses.
- 34. Wetlands: those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and delineated as freshwater wetlands by the U.S. Army Corps of Engineers.



2.0 STORMWATER PERMITTING PROCEDURES

2.1 Overview

This chapter provides the user with the information requested by the Fort Jackson concerning land disturbance activities. A discussion of the recommended stormwater management planning process is followed by the details of the Stormwater Management Planning, the submittal, review and approval processes, design standards, technical requirements, inspection requirements and contractor-related requirements.

2.2 Minimum Requirements for Development

2.2.1 Applicability

Stormwater management minimum requirements and standards apply to all land disturbance within Fort Jackson that consists of one or more of the following:

- All development that involves the disturbance of one (1) acre of land or greater;
- Redevelopment that involves the disturbance of one (1) acre of land or greater;
- Any commercial or industrial development that falls under the NPDES Industrial Stormwater Permit; and,
- Development that creates a peak flow increase of greater than one cubic foot per second (1 cfs).

As a general requirement for submittal purposes, all land disturbance activities that fall under these provisions shall require the following as necessary:

- Completed SCDHEC Land Disturbance Checklist.
- Construction drawings, and
- Technical Report.

2.2.1.1 SCDHEC Land Disturbance Checklist

This checklist requires submitters to enter the technical report page number for each item so that the reviewer can easily find important information. This checklist will also help to ensure all necessary information is submitted.

It contains sections corresponding to hydrology, hydraulics, storm sewer design, BMP design, including detention ponds, erosion control design, and maintenance schedules. The SCDHEC checklist can be found in Appendix S.



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2.2.1.2 Technical Report

The technical report contains all of the engineering details of the proposed development project in an understandable, legible document. Failure to provide all the information required in this section may result in the denial of receiving approval from Fort Jackson and coverage under the General Permit. The items listed as the technical report submission requirements shall be used as a checklist to verify that all required items are properly submitted.

Possible sections of the technical report include, but are not limited to:

- Watershed information,
- Hydrologic information,
- Storm sewer design information,
- Channel design information,
- Erosion Prevention and Sediment Control (EPSC) plans design information,
- Detention/Retention facilities design information,
- Water quality/BMPs design information,
- Outlet velocities, and
- Maintenance schedules.

The details of requirements for each of these topics are provided in the following chapters

2.2.2 Exemptions

The following development activities within the fort shall be exempt from the minimum regulations and standards:

- Development that does not disturb more than 1 acre of land are exempt from parts of NPDES requirements.
- Development that does not create a peak flow increase of greater than one (1) cfs.
- Land disturbing activities on agricultural land for production of plants and animals useful to man.
- The construction of agricultural structures of one or more acres, such as broiler houses, machine sheds, repair shops and other major buildings which require the issuance of a building permit shall require the submittal and approval of a Stormwater Management Plan.



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- Customary and routine grounds maintenance, landscaping, and home gardening which does not require a zoning use exception or building permit, and does not affect stormwater drainage entering or leaving any public right-of-ways.
- Land disturbance activities undertaken on forest land for the production and harvesting of timber and timber products.
- Land disturbing activities that are conducted under another State or Federal environmental permitting, licensing, or certification program where the State or Federal environmental permit, license, or certification is conditioned on compliance with the minimum standards and criteria developed under this Handbook.
- Any land disturbing activities undertaken by any entity that provides gas, electrification, or communication services, subject to the jurisdiction of the South Carolina Public Service Commission.
- Emergency repairs of a temporary nature that are necessary for the preservation of life, health, or property and are made under circumstances where it would be impracticable to obtain a Stormwater Management Permit.

2.2.3 Blanket Utility Coverage

Utility companies that are responsible, either directly or indirectly, for the construction, installation, and maintenance of conduits, pipes, pipelines, cables, wires, trenches, vaults, manholes, and similar structures or devices for the conveyance of natural gas (or other types of gas), liquid petroleum products, electricity, telecommunications (telephone, data, television, etc.), or water or sewage may choose to register annually under the statewide blanket Notice of Intent or may choose to complete a Contractor Certification Form for each project or construction site. Once registered, blanket utilities may perform construction-related activities within common developments or Larger Common Plans (LCP) with approved Stormwater Pollution Prevention Plans (SWPPPS) in the state of South Carolina.

The Annual Blanket NOI (AB-NOI) provides coverage of registered utility providers or contractors performing construction-related activities within common developments in the state of South Carolina under an approved SWPPP. Providers typically will be public utility companies or smaller companies. Land-disturbing activities performed by the blanket provider, the location of utilities, and potential impacts in terms of wetlands impacts, stormwater management, sediment control and erosion prevention must have been accounted for within the approved SWPPP for the construction project/site. In instances where this has not occurred, either the current Owner/Operator must obtain an approved modification or new permit coverage that accounts for the information above OR the blanket utility provider may be required to obtain an individual permit coverage and submit a new NOI and Comprehensive SWPPP to ENV as a Primary Permittee for the proposed utility installation(s) prior to performing work.



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Prior to performing any construction-related (land-disturbing) activities at a construction site where the activities are already covered under the NPDES CGP, each Annual Blanket Utility Provider must provide proof of registration to the Primary or Secondary Permittee. The utility provider may submit a copy of the approved AB-NOI or alternative documentation provided by the Department to the permittee. Registered Annual Blanket Utility Providers are also required to attend a Pre-Construction Conference for the project/site. The Project Owner/Operator must maintain a copy of the Annual Blanket NOI (AB-NOI) and/or equivalent written registration documentation provided by the Department with the approved On- Site SWPPP (OS-SWPPP).

2.2.4 Spill Prevention Plans

A Spill Prevention Plan (SPP) has been developed for Fort Jackson and is included in *Appendix A*. An additional SPP may be required for special circumstances depending on the specifics of the project and the discretion of Fort Jackson personnel. The submittal requirements for SPPs will be issued as necessary. US EPA provides information on SPPs on the Office of Wastewater Management website (www.epa.gov/owm).

2.2.5 Steps for Successful Stormwater Management Plans

The design of successful stormwater management plans involves adhering to the following requirements where applicable:

- Pre-submittal site meeting,
- Review of site development requirements,
- Detailed site analysis,
- Creation of the SWPPP,
- Approval and completion of the SWPPP → Final SWPPP.

2.2.5.1 Pre-Submittal Site Meeting

A pre-submittal meeting between Fort Jackson, design professional, and contractor is encouraged on large projects or projects with special considerations. This meeting may take place at the actual site to be developed. This meeting allows all of the entities involved in the land development process to understand the stormwater management requirements and identify the areas on the site that will require the most attention to meet the requirements of the regulations. Major incentives for the pre-submittal site meeting are establishing a partnership between all of the entities involved through the entire development process, and increasing the chances of expedited approval through an early understanding of the permitting and plan requirements. It



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shall be left to the discretion of Fort Jackson if this meeting shall or shall not be required for a specific project.

2.2.5.2 Review of Site Development Requirements

The SWPPP design professional should be familiar with the South Carolina stormwater management requirements (see section 1.6). All other information and guidance can be obtained from this Handbook and the pre-submittal meeting.

The plan design professional must also be familiar with other local requirements and ordinances such as, but not limited to the following:

- Road and utility standards,
- Other Local, State, and Federal regulatory requirements and regulations.

2.2.5.3 Detailed Site Analysis

To better understand the existing topography, hydrology, and hydraulics of the proposed development, the design professional should personally make a field site visit. During this visit, the design professional should collect as much information as necessary to create an accurate existing condition map of the proposed site. An understanding of the existing site conditions should result in the implementation of a SWPPP that will effectively control stormwater runoff quantity and quality from land disturbance impacts. An actual site visit also gives the design professional an initial vision of how the potential stormwater management system can fit with the surroundings and project expectations.

Items to be recorded during the site visit shall include, but are not be limited to the following:

- Topography of the site especially very steep sloped areas,
- Natural drainage patterns, swales, and detention areas,
- Natural perennial flowing streams and intermittent streams,
- Existing floodplain locations and elevations,
- Soil types and evidence of eroded and/or non-eroded soils,
- Existing vegetation including the corresponding density of each type of vegetation, including:
 - trees,



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- grasslands, and
- various ground covers,
- Existing development including roads, buildings, utility easements, parking areas, and ponds,
- Existing stormwater facilities including ditches, storm sewer systems, and detention ponds,
- Adjacent property characteristics and stormwater outfall points,
- Wetlands,
- Critical habitat areas,
- Boundaries of existing wooded areas, and
- Existing buffer areas along natural drainage ways and channels.

2.2.5.4 Creation of a SWPPP

The SWPPP should include construction drawings, engineering calculations, and the stormwater pollution prevention plan (SWPPP). These documents shall consist of maps, narratives, and supporting design calculations for the proposed stormwater system and should include the following sections when applicable:

- Pre-development hydrologic analysis and calculations that determine the existing stormwater runoff volumes, peak flow rates and flow velocities,
- Post-development hydrologic analysis and calculations that determine the stormwater runoff volumes, peak flow rates and flow velocities,
- Stormwater management control facility design:
 - narrative describing the stormwater management control facilities selected and methodologies to be used in their design,
 - location of all stormwater management control facilities,
 - supporting calculations that justify that the facilities meet Fort Jackson and NPDES General Permit requirements, including but not limited to: hydrographs, stage storage volumes, stage-discharge values for water quantity and water quality control facilities and design calculations and elevations for all stormwater conveyance systems,



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- a permanent maintenance plan for each permanent stormwater management facility,
- Erosion and sediment control plan,
 - narrative describing the erosion and sediment control facilities selected,
 - location of all erosion and sediment control facilities,
 - resulting design calculations and trapping efficiencies for all sediment control facilities,
- Downstream analysis calculations showing the effect of post-development design flows on downstream stormwater conveyance systems and channels
- Water quality control plan
 - details on all water quality ponds and/or structures and strategy for controlling first segment of runoff.
- Phased Plan Requirement

For non-linear construction sites disturbing more than 5 acres, the Construction Site Plans must include a phased stormwater management plan. This phased plan identifies all BMPs and grading work implemented during a specific portion of a site's construction sequence (e.g., initial grading and perimeter controls, interim land disturbances through final grading, post-construction and final stabilization). Each phase must be addressed and identified on at least one separate plan sheet.

- For site disturbances less than 10 acres, at least two (2) separate plan phases will be developed. Each plan phase will be addressed separately on at least one single plan sheet, with each sheet reflecting the conditions and the necessary BMPs. The following plan sheets should be included:
 - a. ***Initial Land Disturbance Phase.*** This includes but is not limited to the perimeter BMPs, the necessary sediment and erosion control BMPs to be installed prior to initial/mass grading, and any additional BMPs necessary to keep the construction site in compliance with the SWPPP.
 - b. ***Stabilization Phase.*** This includes but is not limited to all BMPs required to be installed, maintained, and retrofitted during the time required to begin the majority of all construction and grading activities, and the time required to bring the construction site into



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compliance with permanent water quality requirements and into final stabilization.

- For site disturbances greater than or equal to 10 acres, at least three (3) separate plan phases will be developed. Each plan phase will be addressed separately on at least one single plan sheet, with each sheet reflecting the conditions and the necessary BMPs.
 - a. ***Initial Land Disturbance Phase.*** This includes but is not limited to the perimeter BMPs, the necessary sediment and erosion control BMPs to be installed prior to initial/mass grading, and any additional BMPs necessary to keep the construction site in compliance with the SWPPP.
 - b. ***Construction Phase.*** This includes but is not limited to all sediment and erosion control BMPs necessary to be installed, maintained and designed to prevent sediment-laden stormwater from discharging off-site during construction. Examples of such BMP control measures to include in this phase are all temporary BMPs used to convey, manage, and treat stormwater runoff including additional sediment traps and sediments basins, rock check dams, silt fence, sediment tubes, inlet protection, temporary conveyance channels and any other sediment control measure.
 - c. ***Stabilization Phase.*** This includes but is not limited to all BMPs required to be installed, maintained, and retrofitted during the time required to begin the majority of all construction and grading activities, and the time required to bring the construction site into compliance with permanent water quality requirements and into final stabilization.

More details of all elements that should be in the SWPPP are provided in the later sections of this Handbook. A complete SWPPP will be submitted to Fort Jackson for review and approval before initiating any construction activities on the proposed development site. Fort Jackson reserves the right to reject a SWPPP and request a revision to address any deficiencies. If approved, the plan then becomes the Final SWPPP.

2.2.5.5 Approval and Completion of the SWPPP

If necessary, the revised SWPPP shall reflect any changes or modifications requested or required by Fort Jackson and add further detail to the previously submitted plan. The improved version of the SWPPP shall be resubmitted to Fort Jackson. Upon approval, this plan shall become the Final Stormwater Management Plan. Approval from Fort Jackson shall be required prior to



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initiating any construction activities on the proposed development site. Fort Jackson reserves the right to deny approval until the SWPPP meets the requirements defined in this Handbook.

Once the Final SWPPP is in place, Fort Jackson can issue the approval of land disturbance activities.

2.3 Requirements for Routine Activities and Maintenance

1. Establishment of Permanent Vegetation: The establishment of permanent vegetation is essential in most erosion control applications. To be successful in establishing vegetation on the sandy soils at Fort Jackson, always apply lime and fertilizer. Lime raises the pH of the acidic sandy soils; fertilizer adds nutrients to the soil for adequate plant growth. Without lime to adjust the pH, fertilizer has little effect. (A supplemental application of fertilizer should be applied during the second growing season to provide adequate nutrition and to sustain plant growth.) Once lime and fertilizer are incorporated, seed should be planted using conventional, broadcast, or hydroseeding methods. Conventional or broadcast methods are preferred because seed is placed into and in contact with the soil thus providing a better opportunity for seed germination. Straw mulch is important to protect the bare soil from raindrop impact and help to hold in moisture for seed germination.

Planting Specifications

- Prepare seedbed
- 1.5 tons of agricultural lime per acre (70# per 1000 square feet)
if hydroseeding, 2 gallons liquid lime per acre in addition to agricultural lime
- 700 # of 10-10-10 fertilizer, or equivalent, per acre (16# per 1000 square feet)
- Incorporate lime and fertilizer.
- Plant seed using conventional planting, broadcast, or hydroseeding methods
- Mulch with 1 ½ tons per acre wheat straw
- Crimp straw into soil or use a tackifier to hold straw in place
- When hydroseeding, HECP is acceptable mulch.
- Apply supplemental fertilizer during second growing season at an approximate rate of 300 – 500 pounds per acre of 10-10-10 or equivalent (7-11# per 1000 square feet).



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Turf Mixture for Spring/Summer Seeding in Mowed and Maintained Areas (Optimum Date to Plant is 1 March to 15 July)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|---|-----------------|-----------------------|------------------|-----------------------|------------|
| Browntop Millet | 10# | 4 oz | 98 | 85 | (4) |
| Hulled Common Bermudagrass (hulled = hull absent) | 25# | 10 oz | 97 | 85 | |
| Bahiagrass | 30# | 12 oz | | | |

Turf Mixture for Spring/Summer Seeding in Mowed and Maintained Areas (Optimum Date to Plant is 1 March to 15 July)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|---|-----------------|-----------------------|------------------|-----------------------|------------|
| Browntop Millet | 10# | 4 oz | 98 | 85 | (4) |
| White Clover | 5# | 2 oz | | | (2) |
| Hulled Common Bermudagrass (hulled = hull absent) | 25# | 10 oz | 97 | 85 | |
| Bahiagrass | 30# | 12 oz | | | |

Turf Mixture for Fall Seeding in Mowed/Maintained Areas (Optimum Date to Plant is 1 September to 15 November) *

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|---|-----------------|-----------------------|------------------|-----------------------|------------|
| Rye (Grain) | 10# | 4 oz | 97 | 85 | (5) |
| Unhulled Common Bermudagrass (with hulls) | 130# | 52 oz | 97 | 85 | |

Turf Mixture for Fall Seeding in Mowed/Maintained Areas (Optimum Date to Plant is 1 September to 15 November)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|---|-----------------|-----------------------|------------------|-----------------------|------------|
| Rye (Grain) | 15# | 6 oz | 97 | 85 | (5) |
| Crimson Clover | 20# | 8 oz | | | (2) |
| White Clover | 5# | 2 oz | | | (2) |
| Unhulled Common Bermudagrass (with hulls) | 30# | 12 oz | 97 | 85 | |



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Turf Mixture for Winter Seeding in Mowed/Maintained Areas (Optimum Date to Plant is 1 January to 1 March) *

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|-------------------------------|-----------------|-----------------------|------------------|-----------------------|------------|
| Rye (Grain) | 10# | 4 oz | 97 | 85 | (5) |
| Bahia | 30# | 12 oz | | | |
| Unhulled Bermuda (with hulls) | 65# | 26 oz | 97 | 85 | |

Turf Mixture for Winter Seeding in Mowed/Maintained Areas (Optimum Date to Plant is 1 January to 1 March)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|-------------------------------|-----------------|-----------------------|------------------|-----------------------|------------|
| Rye (Grain) | 15# | 6 oz | 97 | 85 | (5) |
| Crimson Clover | 20# | 8 oz | | | (2) |
| White Clover | 5# | 2 oz | | | (2) |
| Bahia | 30# | 12 oz | | | |
| Unhulled Bermuda (with hulls) | 30# | 12 oz | 97 | 85 | |

Note: ENV may in some cases require or allow deviations from the seeding schedule. Establishment of vegetation is one of the most effective and cost efficient, erosion prevention BMPs. Establishment of vegetation may require soil testing and preparation. ENV encourages consultation of *SCDOT Supplemental Specification for Seeding (SC-M-810-2)* or latest revision for temporary or permanent vegetation.

Tall Grass Mixture for Spring/Summer Seeding in Unmowed Areas (Optimum Date to Plant is 1 March to 15 June)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|--|-----------------|-----------------------|------------------|-----------------------|------------|
| *Oats | 10# | 4 oz | 98 | 85 | |
| Browntop Millet | 10# | 4 oz | 98 | 85 | |
| Bahiagrass | 25# | 10 oz | 65 | 70 | |
| Appalow sericea Lespedeza (scarified) | 20# | 8 oz | 98 | 85 | (1) (2) |
| Kobe lespedeza | 5# | 2 oz | 97 | 85 | (1) (2) |
| Switchgrass | 2 PLS | 1 oz | | | (3) |

* Oats should be added to mixture if seeding date is prior to April 15.



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Tall Grass Mixture for Spring/Summer Seeding in Unmowed Areas (Optimum Date to Plant is 1 March to 15 June)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|-----------------|-----------------|-----------------------|------------------|-----------------------|------------|
| Hairy Vetch | 10# | 4 oz | | | (2) |
| Browntop Millet | 10# | 4 oz | 98 | 85 | |
| Bahiagrass | 30# | 12 oz | 65 | 70 | |
| Switchgrass | 2 PLS | 1 oz | | | (3) |

Tall Grass Mixture for Fall/Winter Seeding in Unmowed Areas (Optimum Date to Plant is 1 September to 15 November or 1 January to 1 March)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|---|-----------------|-----------------------|------------------|-----------------------|------------|
| Rye (Grain) | 56# | 23 oz | 97 | 85 | |
| Bahiagrass | 40# | 15 oz | 65 | 70 | |
| Appalow sericea Lespedeza (unscarified) | 60# | 24 oz | 98 | 85 | (1) (2) |
| Switchgrass | 2 PLS | 1 oz | | | (3) |
| Crimson Clover | 5# | 2 oz | | | |

Tall Grass Mixture for Fall/Winter Seeding in Unmowed Areas (Optimum Date to Plant is 1 September or 1 January to 1 March)

| Seed | Pounds per Acre | Ounces per 1000 Sq Ft | Minimum % Purity | Minimum % Germination | Foot-notes |
|-------------------------------------|-----------------|-----------------------|------------------|-----------------------|------------|
| Hairy Vetch Or Crimson Clover | 10# 20# | 4 oz 8 oz | | | (2) |
| Rye (Grain) | 15# | 6 oz | 97 | 85 | |
| White Clover | 5# | 2 oz | | | (2) |
| Unhulled Bermuda (with hulls) | 30# | 12 oz | 97 | 85 | |
| Switchgrass | 2 PLS | 1 oz | | | (3) |



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Footnotes:

- (1) Includes hard seed.
 - (2) Inoculated with an appropriate culture of nitrogen-fixing bacteria. The inoculate shall be applied in accordance with the manufacturer's directions. (If hydroseeding, use 4 times the recommended rate or inoculant)
 - (3) Pure live seed: Seed germination shall not be less than 50%.
 - (4) **Mow Millet (*no lower than 3 inches*)** once it reaches a height of **18 inches** to reduce competitiveness with permanent vegetation.
 - (5) **Mow Rye Grain (*no lower than 3 inches*)** once it reach a height of **6-8 inches** to reduce competitiveness with permanent vegetation.
2. Storm Drain Inlet Protection: Many times, land disturbing activities - even small ones - take place adjacent to storm drains. Sediment can easily enter these drains and be deposited in ponds, streams, wetlands, and/or off the installation. To prevent this, storm drain inlets should be protected using silt fence inlet protection, or stone.
3. Storm Drain Outlet Protection: Once storm water runoff enters a storm drain system, resistance in the pipe is minimal and the drop in elevation can be significant. The result is stormwater exiting the outlet pipe at significantly increased velocities causing soil erosion. All outlets should be protected with rip rap to decrease water velocity and protect the soil. The outlet should be excavated and the rip rap placed so that water flows over the rock rather than through the rock. Geotextile filter fabric should always be placed underneath the rip rap.
4. Silt Fence: Silt fence should be placed below disturbed areas where the size of the area is no more than ¼ acre per 100 feet of silt fence length, the maximum slope length behind the fence is 100 feet and the maximum gradient behind the fence is 25 percent.
5. Tracking: Many times slopes are disturbed for maintenance or various construction activities. Before the slope is seeded, run a bulldozer up and down the slope. The tracks make grooves in the soil. Broadcast seed on the tracked slope. Rainwater runoff collects in the track grooves providing a moist environment for seed germination. After straw mulching is completed, run the bulldozer up and down the slope again to tack the straw into the soil.

2.4 Submittal Requirements for Sites with Less than 1 Acre Disturbed

The person or entity responsible for any land disturbing activity that disturbs less than 5,000 sf of land, and is not part of a larger common plan development, shall submit a Simplified SWPPP. The steps to creating a robust stormwater management plan as discussed above should be



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followed where applicable and appropriate. This plan requires approval by Fort Jackson. The Simplified SWPPP shall contain the following items:

- Narrative description of the stormwater management facilities to be used,
- General description of topographic and soil conditions at the development site,
- General description of the adjacent property and description of existing structures, buildings, and other fixed improvements located on surrounding properties,
- A sketch to accompany the narrative containing the following when applicable:
 - site location drawing of the proposed project showing project location in relation to roadways, jurisdictional boundaries, streams, rivers and the boundary lines of the site to be developed,
 - all areas within the site that will be included in the land disturbing activities shall be identified and the total disturbed area shall be calculated,
 - anticipated starting and completion dates of the various stages of the land disturbing activities and the expected date of final stabilization shall be noted,
 - location of temporary and permanent stormwater management controls,
- Stormwater management plans shall contain certification by the persons responsible for the land disturbing activities that the activities will be accomplished pursuant to the plan.

2.5 Submittal Requirements for Sites with Greater Than or Equal to 1 Acre Disturbed

The person or entity responsible for any activity that is disturbing one acre or more acres, shall submit a Land Disturbance Submittal Package as defined by this section. This action should be preceded by the submittal of a Stormwater Concept Plan, if requested by Fort Jackson. This plan requires approval by Fort Jackson. The site plans, erosion and sediment control plans, specifications, and supporting calculations and computations shall be submitted and stamped/sealed by professionally licensed engineers, landscape architects, Tier B land surveyors, or other qualified Federal Government employees. The steps to creating a robust stormwater management plan as discussed above should be followed where applicable and appropriate.

The remainder of this section of the Handbook explains the information required to attain the desired Land Disturbance Permit from Fort Jackson. The items discussed in this section of the Handbook should be used as a checklist prior to the submittal of the permit application. The



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Land Disturbance Submittal Package can be processed efficiently if all necessary information is included with the permit application. With proper planning and coordination, the permit processing time requirements can be kept to a minimum.

2.5.1 Land Disturbance Permit Submittal Package Contents

The initial Land Disturbance Submittal Package shall contain:

- A completed SC DHEC Form #2612 - Notice of Intent (to comply with NPDES General Permit SCS00000000),
- A completed SCDHEC SWPPP Checklist
- One (1) copy of the Final SWPPP, including all necessary supporting technical calculations, and
- One (1) complete set of certified (w/ COA) and signed construction plans and specifications,
- All necessary fees (see Section 1.8).

All application forms required for submittal are provided in the appendices of this Handbook. Other avenues may be available in the future.

2.5.2 Stormwater Facility Ownership and Maintenance

2.5.2.1 Ownership

All permanent stormwater management facilities shall be owned and maintained by Fort Jackson.

2.5.2.2 Maintenance

A permanent maintenance plan for each permanent stormwater management facility shall be included in the Final SWPPP. This will allow Fort Jackson to plan and coordinate future maintenance activities.

2.6 Plan Submittal, Review, and Approval Process

2.6.1 Plan Submittal

When the Fort Jackson receives the initial Submittal Package, it shall be reviewed by a certified plan reviewer for compliance. After the plans have been reviewed to determine compliance with the regulations set forth by this Handbook, the plan reviewer will contact the applicant/design



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professional and request any necessary changes, or notify the applicant/design professional that the plans are in compliance. The flow chart in *Appendix B* details the approval process.

2.6.2 Plan Review Period

The Stormwater Concept Plan may be reviewed if needed with the designer and will be approved, approved with changes, or rejected.

Upon approval of the Stormwater Concept Plan and receipt of the Final SWPPP, a complete Submittal Package is to be submitted, after which, Fort Jackson shall accomplish its review and have either the approval or review comments transmitted to the applicant.

2.6.3 Waivers and Variances

The site constraints or unique requirements of a project may present the need for a waiver or variance. All requests shall be submitted in writing with justification. A waiver or variance request may be approved, approved with changes, or rejected. Final approval will be given at the discretion of the Department of Public Works. Fort Jackson will make all efforts to conduct its review of a waiver or variance submitted by the applicant within twenty (20) working days of the submittal.

2.6.3.1 Water Quantity Waiver

If the 2- and 10-year, 24-hour post developed flow rates exceed the pre-developed rates, a waiver from detention may be granted on a case by case basis. Justification and a written request must be submitted, and a final approval will be given at the discretion of the Department of Public Works. A water quantity waiver doesn't excuse water quality considerations. The waiver request must show that:

1. The proposed project does not create any significant adverse effects on the receiving stormwater system downstream of the property, and
2. The imposition of peak flow rate or volume control for stormwater management would create, aggravate, or accelerate downstream flooding or cause a detrimental impact to the downstream ecosystem.

2.6.4 Incomplete Stormwater Management Permit Applications

Engineering design plans, permit applications, specifications, and submittal packages submitted to Fort Jackson that do not meet the minimum requirements of this Handbook shall be handled in the following manner:



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- If the original Submittal Package has all of the major components in accordance with Chapter 3 but is missing some information, a written notice will be sent to the applicant.
- The written notice from Fort Jackson shall state the following:
 - the specific information that must be re-submitted to Fort Jackson in order for the permit application to be considered complete for review and processing,
 - the Submittal Package has been removed from the review process,
 - re-submittal of the Submittal Package with all of the required modifications shall return the application to the review process.
 - Fort Jackson shall hold the incomplete plan for a period of 60 working days from the date of the written notice.
- If an adequate response is not received within 60 working days, the submittal shall be rejected, and the entire submittal process must be initiated again.

If the original Submittal Package does not contain the major required components, it shall be returned to the applicant for re-submittal without review.

2.6.5 Plan Approval and Final Submittal

When the plans have been determined to be in compliance, then the applicant/design professional shall send four (4) additional copies of the Submittal Package to Fort Jackson for final approval to Fort Jackson.

Approved plans remain valid for two (2) calendar years from the date of approval. Extensions or renewals of the approved plans shall be granted by Fort Jackson upon written request by the person responsible for the land disturbing activity.

The Final SWPPP shall not be considered approved without an approval stamp with a signature and date on the plans by Fort Jackson. The stamp of approval on the plans is solely an acknowledgement of satisfactory compliance with the requirements of the MOI. The approval stamp does not constitute a warranty to the applicant or any other person concerning safety, appropriateness or effectiveness of any provision, or omission from the Final SWPPP.

Approvals of land disturbing activities that were approved prior to the effective date of this Handbook shall remain in effect for the original term of the approval. For land disturbing activities which were not initiated during the original term of approval, the person responsible for the land disturbing activity shall re-submit the Final SWPPP to Fort Jackson for review and approval subject to the requirements of this Handbook.



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2.6.5.1 Notification of Work

The contractor shall provide a written Notification of Work (NOW) to Fort Jackson on the planned commencement of construction a minimum of 48-hours prior to the commencement. See the Section 1.7 for contact information.

A Stop Work Order shall be issued on all projects proceeding without the required NOW approval.

2.7 Construction Requirements

The responsibility and importance of contractors in land disturbance activities should not be overlooked and considered secondary. The contractor's adherence or lack thereof to the approved SWPPP is instrumental in the protection of the existing hydrologic and hydraulic features. Several contractor related issues that should be addressed in the SWPPP are listed below.

- Slopes which exceed (8) vertical feet should be stabilized with synthetic or vegetative mats, in addition to hydroseeding. It may be necessary to install temporary slope drains during construction.
- Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after work has ceased (temporarily or permanently) except as provided below:
 1. Where snow cover or frozen ground conditions preclude stabilization by the 14th day, stabilization measures must be initiated as soon as practicable.
 2. Where construction activity on a portion of the construction site is temporarily ceased, and earth-disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the construction site.
- All sediment and erosion control devices shall be inspected every calendar week and inspections are recommended after each rainfall occurrence that exceeds ½ inch. Damaged or ineffective devices shall be repaired or replaced, as necessary.
- Provide silt fence and/or other control devices, as may be required, to control soil erosion during utility construction. All disturbed areas shall be cleaned, graded, and stabilized with grassing immediately after the utility installation.
- All erosion control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed



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areas have been stabilized. Additional control devices may be required during construction, in order to control erosion and/or offsite sedimentation. All temporary control devices shall be removed once construction is complete and the site is stabilized.

- The contractor must take necessary action to minimize tracking of mud onto paved roadway from construction areas. The contractor shall daily remove mud/soil from pavement as may be required.
- Permittees shall either maintain an on-site rain gauge or use data from a certified weather record (such as a personal weather station or an airport) located within a reasonable proximity of the construction site, to record rainfall records from any significant rainfall event, 0.5 inches or greater. These recorded rainfall amounts must be maintained in a Rain Log located on-site in each weekly inspection. A rain gauge record form can be found in Appendix M of this handbook.

2.7.1 Non-Numeric Effluent Limits

The SWPPP must be developed so that the design, installation and maintenance of all sediment control and erosion prevention BMPs are implemented in a manner to minimize the discharge of pollutants. At a minimum, such BMPs must be designed, installed and maintained to:

I. Control Stormwater volume and velocity within the site to minimize soil erosion during construction activity.

(a). **Stormwater volume control** must be accomplished during construction activities to minimize erosion within the boundaries of the construction site. This can be accomplished through the use of various BMPs and techniques including, but not limited to, the following:

- Limiting of the amount of disturbed area not stabilized at a time;
- Staging and/or phasing of the construction sequence;
- Sediment Basins and Sediment Traps;
- Diverting off-site flow around the construction site; and
- Controlling the drainage patterns within the construction site.

(b). **Stormwater velocity control** must be accomplished during construction activities to minimize erosion within the boundaries of the construction site. This can be accomplished through the use of various BMPs and techniques including, but not limited to, the following:

- Surface roughening along slopes;
- Sediment basins and traps;
- Level Spreaders;
- Erosion control blankets;



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- Turf reinforcement mats;
- Riprap; and
- Staging and/or phasing of the construction sequence.

II. Control Stormwater discharges, including both peak flow rates and total Stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion during construction activity.

(a). **Stormwater Volume Discharge Control** must be accomplished during construction activities to minimize erosion at outlets and to minimize downstream channel and stream bank erosion. This can be accomplished through the use of various BMPs and techniques including, but not limited to, the following:

- Surface outlets; and
- Water quantity storage within impoundments.

(b). **Peak Flow Rate Discharge Control** must be accomplished during construction activities to minimize erosion at outlets and to minimize downstream channel and stream bank erosion. This can be accomplished through the use of various BMPs and techniques including, but not limited to, the following:

- Energy dissipaters;
- Level spreaders;
- Riprap aprons;
- Erosion control blankets; and
- Turf reinforcement mats.

III. Minimize the amount of soil exposed during construction activity.

(a). Implement a phased stormwater management plan that limits the amount of exposed soil during construction by outlining the Limits of Disturbance for each phase and by labeling areas that are not to be disturbed throughout the course of construction activities or until a later phase of construction activities.

(b). Outline the Limits of Disturbance on the construction plans and label areas within the construction site that are not to be disturbed.

(c). Stabilize exposed areas as soon as practical to limit the duration of large areas of exposed soil.

(d). Implement temporary seeding techniques.

IV. Minimize the disturbance of existing steep slopes (i.e., slopes of 30% (~3H:1V) or greater), unless infeasible. If steep slopes must be disturbed, or are created through grading activities, the C-SWPPP must:



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- (a). **Divert flows around steep slope disturbances.** Divert concentrated or channelized flows of Stormwater away from and around areas of disturbance having steep slopes;
- (b). **Use BMP Controls.** Use appropriate erosion prevention and sediment control BMPs such as permanent seeding with soil binders, erosion control blankets, surface roughening, continuous slope length reduction through terracing or diversions, gradient terraces, interceptor dikes and swales, grass-lined channels, pipe slope drains, subsurface drains, level spreaders, rock ditch checks, seep berms, and sediment dikes; and
- (c). **Stabilize Promptly.** Initiate stabilization measures on any exposed steep slope area where land-disturbing activities have permanently or temporarily ceased, and will not resume for a period of 7 calendar days.

V. Minimize sediment discharges from the site during construction activity.

- (a). The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of the resulting Stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the construction site, while minimizing sediment discharges to the maximum extent practical;

VI. Provide and maintain natural buffers

- (a). Provide and maintain natural buffers around surface waters and, after stormwater runoff is treated by the construction site's BMPs, direct the construction site discharges into these vegetated areas to increase sediment removal and maximize Stormwater infiltration, unless infeasible during construction activity. Additional information for Buffer requirements can be found in Chapter 3 of the handbook.

VII. Minimize soil compaction and, unless infeasible, preserve topsoil.

- (a). **Soil Stabilization.** Permittees are required to initiate stabilization measures as soon as practicable whenever any clearing, grading, excavating or other earth disturbing activities have permanently or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. Stabilization must be completed as soon as practicable. For areas where initiating stabilization measures is infeasible (e.g., where snow cover, frozen ground, or drought conditions preclude stabilization), initiate vegetative or non-vegetative stabilization measures as soon as practicable.

VIII. Trenches and Excavations Dewatering.

Permittees are required to minimize the discharge of pollutants from dewatering trenches and excavations. Per the Construction General Permit, discharges are prohibited unless managed by appropriate BMPs for stormwater and non-stormwater discharges.

IX. Pollutant Discharge Minimization During Construction Activity.



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Permittees are required to design, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants during construction activity. At a minimum, such measures must be designed, installed, implemented and maintained to:

- Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
- Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site to precipitation and to stormwater; and
- Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.

X. Prohibited Discharges.

The following discharges from sites are prohibited:

- Wastewater from washout of concrete, unless managed by an appropriate control;
- Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance
- Soaps or solvents used in vehicle and equipment washing.

2.7.2 Record Keeping

An appendix must be added to the OS-SWPPP to track the progress, compliance, and modifications of the construction site. These logs may include, but are not limited to; Pre-Construction Conference Log (Appendix N), Construction Inspection Log (Appendix R), Soil Stabilization Log (Appendix O), Rain Record Log (Appendix M), Contractor and Subcontractor Log (Appendix P), Modification Log (Appendix Q) and/or any additional record keeping as deemed necessary by the Permittee.

2.7.3 Major and Minor Modifications

Each SWPPP must be modified if during inspections or investigations it is determined that any SWPPP is ineffective in either eliminating, when reasonably possible, or significantly minimizing pollutants in stormwater discharges from the construction site. Each SWPPP must be modified as necessary to include additional or modified BMPs, which are designed to correct problems identified during the construction site inspection by any qualified inspector, or ENV Revisions to each SWPPP must be completed within seven (7) calendar days following the



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inspection. All modifications (major/minor) must be recorded in a modification log. A Modification Log form can be found in Appendix Q of this handbook.

2.7.3.1 Major Modifications

Each SWPPP must be modified and submitted for review and approval by ENV if any of the following conditions are met:

- a. Whenever there is a significant change in design, construction, operation, or maintenance at the construction site resulting in discharges that will cause, have the reasonable potential to cause, or contribute to violations to SC's Water Quality Standards.
- b. Whenever a change in the design, construction, operation, or maintenance calls for a revision of any approved SWPPP based on the following list of modifications:
 - Modifications that will affect the hydrology or trapping efficiency calculations including:
 - Resizing Sediment or Detention Basins that either reduces the stormwater volume capacity and/or is resized to handle increase/decrease incoming peak flows or runoff volumes due to revised site development plans.
 - Deletion of Sediment or Detention Basin or Sediment Trap.
 - Relocation of Sediment or Detention Basins resulting in increases/decreases in receiving drainage area and/or resulting in a new/relocated basin outlet location, which is directed towards an outfall that was not approved within the C-SWPPP.
 - Removal of Sediment or Detention Basin.
 - Modification of Sediment or Detention Basin Outlet Structure.
 - Changes in grading that alter drainage patterns that may result in increased or decreased flow to a sediment or detention basin
 - Amending Construction Sequence in a fashion that the Detention Basin is not installed before Grubbing Operations begin.
 - Point Discharge or Outfall location changes.
 - Any modification to regulated water quality structural control measures.
 - Adding a new point discharge.
 - Addition of Impervious Area due to revised site development plans.
 - Addition of Disturbed Area.
 - Changes to Navigable Water Crossing.
 - Addition of Sediment Trap(s) when required to obtain 80% Trapping Efficiencies for disturbed areas not previously permitted or redirected away from an approved water quality BMP.



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- Site layout changes that require redesigning the stormwater management system.
- Any additional modifications as determined by ENV.

2.7.3.2 Minor Modifications

The Permittee must modify the On-site SWPPP and keep a record of each modification within the On-Site SWPPP if any of the following conditions are met:

- Addition of BMPs. Addition of Silt Fence, Slope Drains, Inlet Protection, Outlet Protection that does not involve additional wetland impacts, or Check Dams to improve the overall stormwater management and sediment control at the construction site.
- BMP Relocations. Relocation of Construction Entrance, pond inlet pipes (within a pond), and any other proposed BMP to improve the overall stormwater management and sediment control at the construction site.

Removal of Disturbed Areas. As long as the removal of the disturbed area does not also remove any BMPs (ponds, traps, etc.) that are required to meet SC's Water Quality or Quantity Standards. Removal of disturbed area only qualifies for disturbed area that was included in the initial coverage approval and that was never disturbed (i.e., cleared, grubbed or graded).

Modifying Individual Lot Drainage. Unless the changes affect the inflow to a Detention Structure or Analysis Point, to which the lot drains, that was not previously approved.

2.7.4 Deviations from Approved Plans

Substantial deviations from the approved site development plans and specifications shall not be made on-site without written approval from Fort Jackson. Realistically and practically, there are always minor variations to the proposed plan during land development activities. These minor variations will be allowable without the need for approval from Fort Jackson, though sound engineering judgement should be exercised in assessing the impacts of these minor changes.

Examples of substantial deviations that would require written approval from Fort Jackson include, but are not limited to the following:

- pipe size changes,
- pipe grade changes that will affect the hydraulic capacity of the stormwater facilities,
- the movement of stormwater facility that would put them outside of specific easements and right-of-ways, and



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- changes in grade on the site which would effect the direction of stormwater flows, flow velocities, flow volumes, or other hydrologic impacts that would cause the existing plans to fail in protecting water quantity and water quality impacts.

2.7.5 As-Built Requirements

The permittee shall submit an as-built plan certified by a registered professional to Fort Jackson upon the completion of the construction of the stormwater management control structures submitted in the Final SWPPP. The registered professional shall certify the following:

- The facilities have been constructed as shown on the as-built plans and
- The facilities meet the approved site plan and specifications or achieve the function they were designed to perform.

When proposing to direct construction site runoff into a previously approved detention pond or another structural BMP designed to control water quality or quantity, the designer must include an as-built survey of the existing structure prepared by a qualified individual unless an as-built survey has been previously provided and accepted by ENV. The as-built survey will include the following:

- All existing grades/contours/depths of the structure.
- Spot elevations along the top of the structural BMP's embankment.
- Contours, dimension, and locations of all structural components (e.g., forebays, level spreaders, riprap aprons, inlets structures) of the structural BMPs.
- All elevations and dimensions of all outlet structures, including:
 - Pipe and orifice inverts and diameters.
 - Weir elevations and dimensions.
 - Riser dimensions and elevations.
 - Emergency spillway dimensions and elevations.
 - Locations and inverts for all pipes discharging into the pond.

Acceptable as-built plans shall be submitted prior to the use or occupancy of site. Fort Jackson may perform a final inspection upon completion of the installation of stormwater management structures to determine if the work is completed and constructed in accordance with the Final SWPPP.



2.8 Stormwater Controls: Installation, Inspection, and Maintenance

The post-construction stormwater quality control BMPs shall be constructed and implemented in compliance with this Handbook and approved plans that are functioning as intended. Fort Jackson will perform inspections of BMPs to ensure proper functions based on maintenance schedules developed in the SWPPP and approved by Fort Jackson. All maintenance activities and inspections shall be the responsibility of Fort Jackson. If inspection reports that the stormwater control is not functioning as expected within one year after construction activities have concluded, the contractor/design professional shall be required to correct the problem. Most deficiencies should be corrected within a short time period, but allowances will be made for more serious problems.

All constructed stormwater quality BMPs shall require an as-built certification to ensure proper size and water quality volume. All pre-fabricated stormwater quality BMPs shall require a manufacturer's certification that the correct structure is installed properly.



3.0 DESIGN STANDARDS

3.1 Purpose and Intent

This chapter provides engineers, designers, developers, and others with the necessary information needed to design adequate systems that will control the rate, volume, and pollutant loads released from a new or redevelopment project where the Directorate of Public Works has been authorized by law or agreement to enforce engineering standards. These design standards have been developed based on common engineering practice and reference state and federal requirements, engineering publications, and other municipal and academic guidance.

It is the goal of this chapter to provide a minimum set of design standards that will result in effective stormwater management to mitigate the impact of land development on existing/natural hydrologic and hydraulic processes, as well as attempt to prevent further degradation of the water resources in Fort Jackson through proper planning, design, installation, and maintenance. The design professional shall use all means necessary to develop land in a manner consistent with all County Ordinances and this Handbook. Specific methods and applications not covered in this section can and should be discussed with the Directorate of Public Works for applicability. The following section details the criteria that shall be followed in the absence of designated specific watershed master plan criteria.

3.2 General Design Standards

It is an overall goal of this Handbook to address stormwater management to provide effective water quantity and water quality solutions due to the impact of land development on existing/natural hydrologic and hydraulic processes. The following set of criteria shall be followed in the absence of designated specific watershed master plan criteria.

3.2.1 General

The following items are required to be included in the submittal package for a Land Disturbance Permit as part of the SWMP. These items can be presented separately or as part of others sections of the SWMP, i.e. construction documents. This list is followed by technical design requirements.

- Watershed delineation maps with consistent sequential notations,
- Narrative of the existing conditions at the site and the proposed SWMP and all component to be used,
- Location map showing all discharge points and drainage patterns (a 1:24,000 scale USGS topographic map is recommended for this portion),



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- Location/drawing of existing and proposed structures used for stormwater management, including outfalls, the collection system, and erosion control measures,
- Location of identified 100-year floodplains as presented on FIRM maps,
- Identification of any wetlands,
- Identification and classification of all soil types expected to be encountered or used at the development site,
- Presentation existing and proposed contours at the development site,
- General description of the adjacent property and description of existing structures, buildings, and other fixed improvements located on surrounding properties,
- Discussion of all methodologies and models to be used,
- Construction limits and sequence and maintenance requirements during and after construction,
- Site access, and
- Design details and computation for all stormwater management controls, including storage facility routing, pipe capacity and velocity calculations, open channel capacity and velocity calculations, and water surface elevations.

3.2.1.1 Site Design

Site designs shall minimize the generation of stormwater and maximize pervious areas by:

- Selecting portions of the site where the drainage pattern, topography, and soils are favorable for the intended use. Tracts of land vary in suitability for different uses. Knowing the major characteristics of the land area and kinds of soil helps in identifying and evaluating potential problems.
- Exposing the smallest practical area of land for the least possible time during development. This includes maintaining or creating buffers and preserving natural areas.
- Limiting the drainage area to all BMPs. Specific maximum contributing areas to BMPs are provided below.



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- When feasible, retaining and protecting natural vegetation and saving topsoil, for replacing on graded areas.
- Using temporary plant cover, mulching, hydroseeding, or other stabilization methods to control runoff and protect areas subject to erosion during and after construction.

3.2.1.2 Hydrologic Computation Requirements

All hydrologic computations shall be completed using acceptable volume based hydrograph methods. The design storm duration for these computations shall be the 24-hour storm event and a SCS Type II distribution with a 0.1-hour duration time increment. Typical hydrologic input includes but is not limited to the following:

- Rainfall depth or intensity,
- USGS soil classification and hydrologic soil group,
- Land use,
- Time of concentration, and
- Abstraction. The remainder of this section will provide basic information for the hydrologic calculations needed in a project's SWMP. As discussed, the intent of the Handbook is not to provide detail on every aspect of hydrologic computations, their limitations, assumptions, appropriateness of use, etc. However, this Handbook references suggested materials as necessary for detailed discussion of related topics.

3.2.1.2.1 Inputs

The precipitation depths/intensities corresponding to various return periods to be used for projects on Fort Jackson are shown in Table 3.1.

Table 3.1: Design Storm Precipitation Data for Fort Jackson, South Carolina

| 2-yr | 10-yr | 25-yr | 100-yr |
|------|-------|-------|--------|
| 3.6 | 5.3 | 6.4 | 8.3 |

Soil types on Fort Jackson are predominantly sands and sandy clays. *Appendix C* contains a soil map of Fort Jackson. Information on soil type and hydraulic classification for all parts of the fort can be found there. Land use information is required for modeling the appropriate runoff potential for a project. Existing land use and corresponding runoff potential factors should be



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obtained from the site visit. Appropriate runoff potential factors can be found in several of the references listed in Chapter 5.

3.2.1.2.2 Recommended Methodologies

The Fort Jackson recommended methods and corresponding design circumstances are listed in Table 3.2 and Table 3.3 below. If other methods are used, they must first be calibrated to local conditions and tested for accuracy and reliability and then submitted to Fort Jackson for approval. In addition, complete source documentation must be submitted for approval.

Table 3.2: Recommended methodologies based on land disturbance area

| Method | Size Limitations* | Comments |
|----------------------------|-------------------|--|
| (Modified) Rational Method | 0 – 2 Acres | Acceptable for sizing individual culverts or storm drains that are not part of a pipe network or system. <u>Not to be used for storage design.</u> |
| “SCS Method” (TR-55) | 0 – 2000 Acres | Used for estimating peak flows from urban areas. |
| USGS Regression Equation | > 2000 Acres | Used for estimating peak flows for all design applications for areas between 2,000 and 16,000 acres and estimating hydrographs for all design applications for areas between 128 and 16,000 acres. |

*Size limitations refers to the subwatershed size to the point where stormwater management facility (i.e., culvert, inlet, BMP) is located.

Details of Rational Method and Modified Rational Method can be found in Chow (1988), ASCE(1996), USDA (1996, 2001), and Mays (2001). When using this methodology, regional coefficients are needed to calculate the rainfall intensity. These regional coefficients can be found in the Richland County Land Development Regulation, Section 4 (<http://www.richlandonline.com/departments/publicworks/forms/Design%20Standards.pdf>).

SCS Method documentation can be found on the US Department of Agriculture website (http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools_Models/WinTR55.html). The USGS regression equations for South Carolina can be obtained from *Appendix D*, the US Geological Survey website (<http://water.usgs.gov/software/NFF/>). In addition, the US Department of the Army and Air Force (1987a, 1987b) has two technical manuals addressing hydrology, “Surface Drainage Facilities for Airfields and Heliports” and “Drainage for Areas other than Airfields”. Complete references are given in Section 4.



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Table 3.3: Recommended Hydrologic Methods for Designing Various Stormwater Management Systems and Controls

| Method | Rational Method | SCS Method | USGS Equations |
|----------------------------------|-----------------|------------|----------------|
| Extreme Flood Protection | | + | + |
| Storage/Sedimentation Facilities | | + | + |
| Outlet Structures | | + | + |
| Gutter Flow and Inlets | + | | |
| Storm Drain Pipes | + | + | + |
| Culverts | + | + | + |
| Small Ditches | + | + | + |
| Open Channels | | + | + |
| Energy Dissipation | | + | + |

Methods for calculating the time of concentration and abstraction are numerous. However, a minimum time of concentration of six (6) minutes shall be used for all hydrologic calculations. See references given above for the suggested methodologies for information on these calculations.

3.2.1.2.3 Hydrographs

Hydrographs should be used to evaluate entire systems by routing storm events through pipe or storage systems. The use of a hydrograph will provide better insight into a system performance than the use of peak discharge can. SCS (USDA 1986) has developed a tabular hydrograph procedure that can be used to generate hydrographs for small drainage areas less than 2,000 acres. The tabular hydrograph procedure uses unit discharge hydrographs that have been generated for a series of time of concentrations. In addition, SCS has developed hydrograph procedures to be used to generate composite flood hydrographs. The development of a runoff hydrograph from a watershed is a tedious, laborious process not normally performed by hand because of the simplicity of current computer model applications. Chow (1988) is also an excellent reference on this topic. Many computer models are now used to compute these hydrographs using many types of methodologies. Fort Jackson will accept such models once it has been proven to precisely execute a given methodology.



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3.2.1.3 Water Quantity Control Requirements

Water quantity control is an integral component of overall stormwater management. Its purpose is to negate the effects of development on large storm events. Quantity control is effectively flood control, reducing potential damages and health risks. The following design criteria are established for water quantity control. All designs of storage facilities utilized for stormwater quantity control and required downstream analyses shall be submitted with the SWMP when applying for a Land Disturbance Permit.

- Potential controls include above ground wet or dry detention basins, and retention ponds.
- Post-development discharge rates shall not exceed pre-development discharge rates for the 2-, 10-, and 25-year frequency 24-hour duration storm events.
 - Multi-stage control structures may be required to control the 2-, 10- and 25-year storm events.
 - The same hydrologic procedures shall be used in determining both the pre-development and post-development peak flow rates.
- Post-development discharge velocities shall be reduced to provide non-erosive flow velocities from structures, channels or other control measures, or be equal to the pre-development 25-year 24-hour storm event flow velocities, whichever is greater.
- Emergency spillways shall be designed to safely pass the post-development 100-year 24-hour storm event without overtopping any dam structures.
- All dry detention basin volumes shall be drained from the structures within 72 hours. Volume control is encouraged using acceptable BMPs such as engineered devices, infiltration basins, and grassed swales.
- Downstream analysis shall be required for the 2-, 10-, 25-, and 100-year frequency 24-hour duration storm events for all development sites unless a waiver or variance is granted from this analysis. When water quantity controls are implemented, an off-site analysis waiver may not be required, provided that all required design criteria of the Handbook are met. Analysis should be performed for both existing and proposed conditions at a point where development is approximately 10 percent of total drainage area, locations of past quantity issues, where downstream residential sites exist, all road crossings, and others as directed by Fort Jackson. All system components are potential analysis items. Possible actions to mitigate development's impact include on- or off-site control or improvement to downstream conveyance measures. Analysis criteria shall include, but is not limited to:



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- existing land use curve numbers shall be used for developed areas upstream,
 - existing land use for upstream and downstream areas of interest may be used, but future land use, when applicable, is recommended for conservative results,
 - routing of flows using an accepted hydrologic and hydraulic method from Chapters 3,
 - hydraulic step-backwater calculations (Corps of Engineer's HEC-2 or HEC-RAS models or equivalent) shall be performed to determine flood elevations of any downstream impacted areas, and
 - the effects of any upstream and proposed stormwater quantity or quality structures.
- Vegetated embankments shall be less than 15-feet in height and shall have side slopes no steeper than 3H:1V. Embankments protected with Erosion Control Blankets or Turf Reinforcement Matting shall be no steeper than 2H:1V. Geotechnical slope stability analysis is required for slopes greater than 10-feet in height and embankments that have steeper slope than those indicated above.
 - A minimum freeboard of 1-foot above the 100-year 24-hour design storm high water elevation shall be provided for impoundment depth less than 15-feet. Impoundment depths greater than 15-feet are subject to the requirements of the Federal Emergency Management Agency's (FEMA) Dam Safety Guidelines (FEMA 1998) unless the facility is excavated.
 - The bottom of detention structures shall be graded towards the outlet structure to prevent standing water conditions. A minimum 0.5% bottom slope is recommended.
 - The maximum depth of permanent storage facilities shall be determined by site conditions, design constraints, and environmental needs. The facility should provide a permanent pool of water with a depth sufficient to discourage weed growth without creating undue potential for anaerobic bottom conditions. A depth of 6- to 8-feet is reasonable unless fishery requirements dictate otherwise. Aeration may be required for permanent pools to prevent anaerobic conditions. Wildlife experts shall be contacted when aquatic habitat is required.
 - A dam is defined as being an artificial barrier that impounds water to a depth of 15-feet or greater and has a maximum storage volume of 10 acre-feet or greater. Several exemptions may be allowed in FEMA's Dam Safety Guidelines Act and



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any question concerning a specific design application should be addressed to the Fort Jackson.

- An access area is required comprised of a minimum of 10 feet along both sides of all drainage ways, streams, channels, ditches, and around the perimeter of all detention and retention facilities. Sufficient land area for equipment access for basin maintenance shall be provided.
- A safety fence shall be implemented around all stormwater basins that are greater than 2-feet in depth.
- Watersheds that have well documented water quantity problems may have more stringent or modified design criteria determined from master plan studies. Such situations will be dictated by Fort Jackson. Some examples of variable criteria include but are not limited to:
 - post-development discharge rates from the entire development area not exceeding pre-development discharge rates for storm frequencies greater than the 25-year frequency 24-hour duration storm event,
 - post-development discharge volumes from the entire development area not exceeding pre-development discharge volumes,
 - reduction of peak flow rates from pre-development to post-development,
 - reduction of total volume released from pre-development to post-development, and
 - downstream channel, culvert or property improvements.
- A project may be eligible for a waiver from the stormwater management requirements for water quantity control if the applicant can justly verify that:
 - the proposed project will not create any significant adverse effects on the receiving natural waterway downstream of the property and
 - the imposition of peak flow rate control for stormwater management would create, aggravate, or accelerate downstream flooding.

Documentation on the design, installation, and maintenance of storage facilities can be found in USDA (2001b), ASCE & WEF (1994), and Mays (2001).



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3.2.1.3.1 Accepted Storage Controls

Detention structural controls are used for providing water quantity control and are typically used downstream of other minor structural controls. These structures are designed to provide channel protection, overbank flood protection, and any adverse downstream impacts that are related to the increase in peak flow rates and flow volumes from development. Detention structural stormwater controls accepted by Fort Jackson are shown in Table 3.4.

Table 3.4: Accepted Storage Controls

| General Structural Control | Description |
|--|--|
| Dry Detention/Dry Extended Basins | Dry detention basins and dry extended detention basins are surface storage facilities intended to provide temporary storage of stormwater runoff and releasing it at a designed flow rate to reduce downstream water quantity impacts. These structures are designed to completely drain to a dry condition within 72 hours. |
| Wet Stormwater Detention Basins <ul style="list-style-type: none">• Wet Pond• Wet Extended Detention Pond• Micropool Extended Detention Pond• Multiple Pond System | Wet detention basins are constructed stormwater basins that have a permanent pool or micropool of water. Runoff from each rain event is detained above the permanent pool and released at a designed flow rate to reduce downstream water quantity impacts. |
| Multi-purpose Detention Areas | Multi-purpose detention areas are used for one or more specific activities such as parking areas and rooftops. These areas are used to provide temporary storage of runoff. Some of the multi-purpose area such as infiltration trenches or bio-retention areas may also be used for water quality purposes. |
| Underground Detention | Underground detention is used as an alternative to surface dry-detention basins. They are used in areas that are space-limited where there is not enough adequate land to provide the required detention volume. The underground storage utilizes tanks, vaults, and buried pipes to supply the required storage volume. |



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3.2.1.3.2 Design Procedures

This section provides the general procedures for the design of stormwater quantity structures. The following items shall be required for the design of these structures and routing flows through them:

- Compute the inflow hydrograph for the structure.
- Compute a stage-storage relationship for the proposed structure. A stage storage-curve defines the relationship between the depth of water and storage volume within the detention facility.
- Compute stage-discharge relationship of the outlet control structure(s).
- Perform routing calculations for the 2-, 10-, 25- and 100-year 24-hour storm events. These may be done by hand, or may be done by using a storage routing computer model.
- Evaluate the control structure outlet flow velocity and provide velocity control and channel stabilization if needed. Standard drawings are provided for preferred outlet structures. Other will be accepted once evidence is submitted proving its ability to perform as designed.

Routing of hydrographs is critical to the proper design of stormwater quantity control structures. Storage design procedures have been formulated without using routing, but the use of these methods in designing stormwater quantity structures has not produced acceptable results for the Southeastern United States.

Stage-storage and stage-discharge calculations should be included in the SWMP. Common methodologies for stage-storage curves include the double end area method, and the pyramid frustum method. Other methods will be accepted upon justification of their integrity.

Hand calculations are available for routing hydrographs through detention structures, however they are time consuming and inefficient when multiple designs are required to be evaluated. For this Handbook, it is assumed that the design professional will be using one of the many computer software packages available to perform storage routing calculations. All models/methodologies used should be acceptable to Fort Jackson.

3.2.1.4 Water Quality Control Requirements

Water quality control is an integral component of overall stormwater management. The following design criteria are established for water quality control unless a waiver is granted on a case-by-case basis.



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- Permanent water quality ponds and water quality structures having a permanent pool elevation shall be designed to store and release the first ½-inch of runoff from the site over a minimum period of 24-hours in addition to satisfying flow rate control for the 2-, 10-, and 25-year storm events. The storage volume of these water quality structures shall be designed to accommodate at least ½-inch of runoff from the entire site. The Urban Drainage and Flood Control District around Denver, Colorado (UDFCD 2003) offers another method for estimating this required water quality volume.
- Permanent water quality structures not having a permanent pool elevation shall be designed to store and release the first 1-inch of runoff from the site over a minimum period of 24-hours.
- Permanent water quality infiltration practices shall be designed to accommodate at a minimum the first 1-inch of runoff from impervious areas located on the site.
- When existing wetlands are intended to be water quality facilities, the Stormwater Management Permit shall not be implemented until all necessary Federal and State permits have been obtained.
- Commercially available products can be used as water quality control measures. Applicability of such devices will be determined on a project-by-project basis.

3.2.1.4.1 Water Quality BMPs

The varieties of water quality BMPs are numerous. With the proper planning, installation, and maintenance, BMPs can be expected to reduce pollutant loads to receiving waters, reduce erosion, provide health and safety benefits, and be cost effective. BMPs are considered either structural or non-structural. Fort Jackson's current approved list of stormwater quality BMPs and a description of each are given in Table 3.5. This is followed by a brief discussion of some recommended non-structural BMPs and suggested innovative approaches, including Low-Impact Development (LID), which are encouraged and accepted. In addition, *Appendix G* includes information on when particular BMPs are appropriate.

All stormwater quality BMPs must be designed in accordance with the Handbook, installed properly, and be properly maintained. Further information on the design of structural BMPs can be found in NVPDC (1992), Schueler (1987), and WEF & ASCE (1998).



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Table 3.5: Structural Controls

| General Structural Control | Description |
|---|---|
| Wet Ponds | Wet stormwater ponds are constructed stormwater basins that have a permanent pool or micropool of water. Runoff from each rain event is detained and treated in the pool, and released at a designed rate. |
| Stormwater Wetlands | Stormwater wetlands are constructed wetland systems used for stormwater management. Stormwater wetlands consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent water surface. |
| Bioretention Areas | Bioretention areas are shallow stormwater basins or landscaped areas that utilize engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance system or partially exfiltrate into the soil. |
| Sand Filters | Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system or partially exfiltrate into the soil. |
| Infiltration Trench | An infiltration trench is an excavated trench filled with stone aggregate used to capture and allow infiltration of stormwater runoff into the surrounding soils from the bottom and sides of the trench. |
| Enhanced Grassed Swales | Enhanced swales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within dry or wet cells formed by check dams or other structures. |
| Engineered Devices <ul style="list-style-type: none">• Vortex Separator• Oil/Water Separator• Filtration• Inlet inserts | Pre-fabricated controls use the movement of stormwater runoff through a specially designed structure to remove target pollutants. They are typically used on smaller commercial sites and urban hotspots. There are numerous commercial vendors of these structures. Select Engineered Devices from SCDOT's Qualified Products List 78 for Stormwater Manufactured Treatment Devices. |

Some structural BMPs have limited applications and recommended only for limited use for special site or design conditions. Generally, these practices can not alone achieve 80 percent TSS removal goal and are intended for hotspots for specific land use constraints or conditions. Limited application controls may be used within a system of water quality controls and are very effective pre-treatment structures for the controls listed in Table 3.5. Limited application



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structural controls should be designed and used only in development situations where regular maintenance is guaranteed. Some popular limited stormwater controls are shown in Table 3.6.

Table 3.6: Limited Structural Controls

| Limited Structural Control | Description |
|---|---|
| Vegetated Filters <ul style="list-style-type: none">• Filter Strip• Grassed Channels and Swales | Both filter strips and grassed channels provide filtering of stormwater runoff as it flows across the vegetation. However, by themselves these controls do not consistently obtain an 80% TSS removal. Both filter strips and vegetated channels shall be used as pretreatment measures or part of a treatment system approach. |
| Submerged Gravel Wetland Systems | Submerged gravel wetlands use wetland plants in a submerged gravel or crushed rock media to remove stormwater runoff pollutants. These systems should only be used in mid- to high- density environments where other structural controls will be utilized. |
| Small Sand Filters <ul style="list-style-type: none">• Surface Sand Filter• Perimeter Sand Filter | Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system or partially exfiltrated into the soil. |
| Porous Paver Systems | Porous paver systems consist of open void paver units laid on gravel subgrade to promote stormwater infiltration. Porous pavers provide water quality and quantity benefits, but have high maintenance requirements. |

Regardless of the control, maintenance schedules should be included for each BMP proposed. This will provide adequate planning and cost allocation to Fort Jackson, who is responsible for all maintenance activities.

Listed below are some non-structural BMPs that should be considered for use in larger land disturbance activities and re-development projects.



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- Disconnected roof drains/impervious areas: directing stormwater runoff from rooftops towards pervious areas where it is allowed to filter through vegetation and other landscaped material and infiltrate into the soil.
- Grass/Porous pavements: allows for the reduction of paved areas by implementing areas that are infrequently used, providing water quality benefits through increased infiltration.
- Cluster development: concentrate development away from environmentally sensitive areas such as streams, wetlands, and mature wooded areas.

3.2.1.5 Buffer Zone Management

In order to minimize sediment discharges, during construction, if surface waters are located on or immediately adjacent to the construction site, the SWPPP must address any stormwater discharges from the construction site to such waters so that these discharges are treated by an undisturbed buffer zone that is capable of achieving maximum pollutant removal.

3.2.1.5.1 Buffer Zone Management Requirements

The SWPPP must identify an undisturbed buffer zone that meets the following criteria when surface waters are located on or immediately adjacent to the construction site:

- 30-Foot, Natural Buffer - Provide and maintain, at a minimum, a 30-foot undisturbed buffer zone during construction. This Natural Buffer should be located between the surface waters and the outermost sediment and erosion controls at the construction site
- 5-Foot, Extended Natural Buffer around Sensitive Waters - Provide and maintain, at a minimum, a 45-foot undisturbed buffer during construction where the surface waters are classified as Sensitive Waters as defined by the South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities. This Extended Natural Buffer should be located between the surface waters and the outermost sediment and erosion controls at the construction site
- Velocity Dissipation Requirements - All discharges into a buffer zone should be non-channelized and non-concentrated to prevent erosion, and must first be treated by the construction site's sediment and erosion controls. Velocity dissipation measures may be implemented within a buffer zone.
- Additional Local Requirements, where applicable - The provided buffer zone should meet any local requirements, if more restrictive. Local Requirements may allow for mechanisms that would affect the width or other parameters of a buffer



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zone given that, in the event that the buffer zone width is less than the required 30ft or 45ft widths, the requirements in Compliance Option B or C.

3.2.1.5.2 Buffer Zone Management Compliance Options

The SWPPP must identify and address each applicable Buffer Zone Management requirements through one of the following Compliance Options.

Option A – Provide the Entire Buffer Width. Provide and maintain, at a minimum, the required buffer zone in addition to the required erosion prevention and sediment control BMPs for the construction site. SWPPPs pursuing this option must also include the following:

- A narrative detailing that a buffer zone is to be maintained at a length of the required buffer width.
- A list of standard notes addressing the maintenance of the buffer zone and supporting BMPs. These notes may be located within the construction site plans.

Option B – Reduction of the Buffer Width. Provide and maintain an undisturbed buffer that is less than the required buffer width in addition to the required erosion prevention and sediment control BMPs for the construction site. Situations qualifying for this option are listed in the Exceptions section of this document. Other situations may be approved for this option on a site-to-site basis. SWPPPs pursuing this option must also include the following:

- A narrative detailing that a buffer zone is to be maintained at a length less than the required buffer width
- A detailed sequence of the procedures and/or controls (including the installation of BMPs, maintenance of BMPs, and removal of BMPs) to be implemented to protect the immediately adjacent or on-site surface waters
- A list of standard notes addressing the maintenance of the buffer zone and supporting BMPs. These notes may be located within the construction site plans.

Option C – Elimination of the Buffer Zone. Provide and maintain the required erosion prevention and sediment control BMPs for the construction site when circumstances restrict the capability of providing a buffer zone. Situations qualifying for this option are listed in Section 3.2.1.5.3 Other situations may be approved for this option on a site-to-site basis. C-SWPPPs pursuing this option must also include the following:

- A narrative justifying why an undisturbed buffer, of any length, will not be provided due to site-specific conditions.



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- A detailed sequence of the procedures and/or controls (including the installation of BMPs, maintenance of BMPs, and removal of BMPs) to be implemented to protect the immediately adjacent or on-site surface waters.
- Calculations which support that the proposed sediment control BMPs are capable of meeting the design criteria.
- Maintenance Notes. A list of standard notes addressing the maintenance of all BMPs discharging into surface waters. These notes may be located within the construction site plans.

3.2.1.5.3 Exceptions

All or portions of the construction site may not be required to meet the entire **30-foot** (45-foot if discharging to Sensitive Waters) buffer widths, if at all, when any of the following circumstances is applicable at the construction site prior to implementation of land-disturbing activities and all items in either Compliance Option B or C are provided.

- Circumstance where construction stormwater runoff will not be discharged into on-site or immediately adjacent surface waters.
- Areas within the required buffer zone that have been developed prior to the issuance of this permit.
- This includes, but is not limited to, surface waters to be impacted and treatment works.
- Under special circumstances, work may be allowed within the designated buffer zones, but only when any of the following apply:
 - Final stabilization measures have been implemented on all disturbed areas discharging to the buffer zone.
 - Implementation of velocity dissipation measures within the buffer zone.
 - Work in the buffer zone will not allow stormwater discharges to cause or contribute to violations of water quality standards.

3.2.1.5.4 Exemptions

Disturbances at the construction site are not required to meet the **Buffer Zone Management** requirements when the C-SWPPP limits the area of disturbance to the minimum needed to complete the construction and to access the site, that all appropriate CWA 404 permits and/or authorizations are obtained, that the SWPPP retains the vegetation outside of the cited disturbed areas, **and** where the construction activity consists solely of any of the following circumstances:



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- ***Linear Projects.*** This includes any linear construction projects, that consists solely of either roadways and/or utilities (such as roads that are not part of a development and utility construction including electrical power lines, gas lines, main sewer trunk lines, and water distribution lines that are not part of a development)
- ***Construction of Water Dependent Structures and Water Access Areas.*** This includes, but is not limited to, piers, boat ramps, and trails
- ***Habitat Restoration Projects.*** This includes, but is not limited to, mitigation requirements;
- ***Routine Maintenance.*** This includes, but is not limited to, the maintenance of existing structures located within the required buffer width; and
- ***2006 Permit Coverage.*** Construction sites covered under the 2006 CGP, per section 3.1.1.F of the 2012 CGP.

3.2.1.5.5 Buffer Maintenance

The selected compliance option must be maintained throughout the duration of all land-disturbing activities until final stabilization has been reached on all areas discharging to the provided buffer zone. Each erosion prevention, sediment control, and velocity dissipating BMP discharging to a buffer zone must be maintained to ensure that each BMP is capable of achieving maximum pollutant removal.

3.2.1.6 Erosion Prevention and Sediment Control Requirements

The following items are required to be included as part of the SWPP addressing erosion prevention and sediment control (EPSC). EPSC plans are required for all activities disturbing more than 5,000 square feet or as required by Fort Jackson. These items can be presented separately or be part of other sections of the SWPPP. Fort Jackson prefers that the EPSC plans be presented separately. This is not only a proactive measure to safeguard downstream environments, but is particularly important due to the erodibility of the soils common on Fort Jackson.

- Location of all erosion and sediment control structures,
- Delineation of all sensitive features and potential sediment sources,
- Installation sequencing and maintenance schedules for all EPSC BMPs during and after construction,
- Provisions to preserve topsoil and limit the amount of total disturbed area,



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- Details of site grading,
- Design details and computations for all EPSC structures,
- Silt fencing shall be placed at the toe of all fill slopes and soil berms and below disturbed areas where the size of the area is no more than $\frac{1}{4}$ acre per 100 feet of silt fence length. The maximum slope length behind the fence is 100 feet and the maximum gradient behind the fence is 25 percent.
- Protection of all storm drain inlets and outlets,
- List of the trapping efficiency for each sediment control structure,
- Calculation of required sediment storage volumes, and
- Explanation of any computer models or software used with highlights of and/or notes on the output data.

The following nonstructural site management practices shall be utilized on the plans where applicable:

- Minimize site disturbance to preserve and maintain existing vegetative cover,
- Limit the number of temporary access points to the site for land disturbing activities,
- Phase and sequence construction activities to minimize the extent and duration of disturbed soil exposure, and
- Locate temporary and permanent soil disposal areas, haul roads and construction staging areas to minimize erosion, sediment transport and disturbance to existing vegetation.

Detailed EPSC plans shall comply with the following specific standards and review criteria:

- Sediment Tracking Control. Stabilized construction entrances shall be located and utilized at all points of ingress/egress on a construction site. The transfer of soil, mud, and dust onto roads shall be prevented.
- Crossings of waterways during construction should be minimized and must be approved by Fort Jackson. Encroachment into stream buffers riparian areas and wetlands should be avoided when possible.
- Topsoil shall be stockpiled and preserved from erosion or dispersal both during and after site grading operations when applicable.



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- Temporary Stabilization Measures. Where construction or land disturbance activity will or has temporarily ceased on any portion of a site, temporary site stabilization measures shall be required as soon as practicable, but no later than 14 calendar days after the activity has ceased.
- Final Stabilization. Final Stabilization of the site shall be required within 14 calendar days of construction completion.
- Temporary Structural Controls installed during construction shall be designed to accomplish maximum stabilization and control of erosion and sedimentation, and shall be installed, maintained, and removed according to the specifications set forth in the Handbook, Standard Specifications and Standard Drawings. All temporary structural controls shall be designed to control the peak runoff resulting from the storm event identified in the Handbook, Standard Specifications and Standard Drawings.
- All Permanent Structural Controls, including drainage facilities such as channels, storm sewer inlets, and detention basins, shall be designed according to the standards set forth in the Handbook, Standard Specifications and Standard Drawings.

3.2.1.6.1 Design Removal Efficiency Goal

Sediment control structures shall be designed to accommodate the anticipated sediment loading from all land disturbing activities and meet a design removal efficiency of 80 percent total suspended solids (TSS) or 0.5 ml/L peak settleable solids concentration, whichever is less, for disturbed conditions for the 10-year 24-hour storm event. Instructions for sediment basin designs can be found in *Appendix K* of the handbook.

3.2.1.6.2 Alternative Erosion Prevention and Sediment Control BMPs

To encourage the development and testing of innovative alternative EPSC BMPs, alternative management practices that are not included in the Handbook or Standard Drawings (*Appendix E*) may be allowed upon review and approval. To use an alternative BMP, the design professional shall submit substantial evidence that the proposed measure will perform at least equivalent to currently approved BMPs contained in the Handbook and Standard Drawings. Evidence may include, but is not limited to:

- Supporting hydraulic and trapping efficiency calculations.
- Peer-review by a panel of licensed professional engineers.
- Research results as reported in professional journals.
- Manufacturer literature.



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3.2.1.6.3 Design Procedures

Control of sedimentation from construction sites may be accomplished through the utilization of a variety of EPSC BMPs. The complexity of the erosion and sediment control plan will vary depending on the individual site conditions. The goal of implementing the erosion control plan is to limit the quantity of sediment being eroded from, and leaving a construction site. This may be partially accomplished through the implementation of EPSC BMPs. However, these sediment trapping controls typically only remove a small portion of the clay particles eroded from the site. The best protection is provided by a combination of practices including temporary and permanent stabilization, flow diversions, and streambank protection, all which minimize the amount of soil that is eroded from the site.

All land development shall be planned in such a way to control and limit erosion and sediment discharge from construction sites using, but not limited to, the BMPs listed in this chapter. The goal of these erosion and sediment control BMPs shall be to:

- Minimize the extent and duration of disturbed soil exposure,
- Protect off-site and downstream locations, drainage systems and natural waterways from the impacts of erosion and sedimentation,
- Limit the exit velocities of the flow leaving the site to non-erosive or pre-development conditions, and
- Design and implement an ongoing inspection and maintenance plan.

3.2.1.6.4 Erosion Prevention Measures

Erosion prevention measures shall be used during and after construction site preparation in order to safely convey clean water to storm drains or adequate watercourses. One or more measures should be utilized as appropriate during the project's construction phase. Such measures may include but are not limited to: phasing and construction sequencing, surface roughening, temporary seeding, mulching, matting, rip-rap or aggregate (channels, aprons, outlets, etc.) and geotextile blankets. Details on each and of these measures and others, including design, installation, and maintenance, can be found in *Appendix E* and SCDHEC (2002).

In addition to site-specific erosion control measures, the grading plan should include the following general measures as a minimum:

- The finished cut and fill slopes to be vegetated should not be steeper than 3H:1V. The finished grades of cut and fill slopes to be vegetated with vines and/or groundcovers should not be steeper than 1H:1V.



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- Cuts or fills should not be so close to property boundaries as to endanger adjoining property without adequately protecting such properties against erosion, sedimentation, slippage, settlement, subsidence, or other damages.
- Subsurface drainage should be provided in areas having a high water table to intercept seepage that would affect slope stability, bearing strength or create undesirable wetness.
- No fill shall be placed where it can slide or wash onto another property.
- Fill shall not be placed adjacent to channel banks where it can create bank failure, reduce the capacity of the stream, or result in downstream sediment deposition.
- All borrow and disposal areas should be included as part of the grading plan.
- Adequate channels and floodways should be provided to safely convey increased runoff from the developed area to an adequate outlet without causing significant channel degradation, or increased off-site flooding.
- The site should be graded to direct flows to appropriate controls.

Initiate soil stabilization measures as soon as practicable whenever land-disturbing activities have been temporarily or permanently ceased, but in no case more than 14 days after land-disturbing activity in that portion of the construction site has temporarily or permanently ceased, except as provided below:

- Where snow cover or frozen ground conditions preclude stabilization by the 14th day, stabilization measures must be initiated as soon as practicable.
- Where construction activity on a portion of the construction site is temporarily ceased, and earth-disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the construction site.

3.2.1.6.5 Temporary Sediment Control Measures

Fort Jackson emphasizes erosion prevention in EPSC plans. However, there are always instances where erosion can not be prevented. For these situations, temporary sediment controls must be implemented to control the migration of eroded sediment off site. The following sediment control measures are applicable as temporary practices for use during construction. One or more of the measures should be utilized as appropriate during the project's construction phase. A discussion of the planned measures will be required during the review of the Stormwater Concept Plan for sites containing sensitive features.



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There are many types of temporary control measures. Some of the more common and suggested include: temporary sediment and multipurpose basins, sediment traps, silt fences, rock and composite check dams, inlet protection, vegetated filter strips, and rock sediment dikes. There are also many proprietary devices such as socks and tubes available for inlet protection, berms, dikes, check dams and many other EPSC purposes. These devices will be evaluated by Fort Jackson as necessary. Details on these and other measures are again not discussed in detail in the Handbook. An excellent reference is Hann, Barfield, and Hayes (1995).

Each sediment control BMP must be designed, installed and maintained to achieve maximum pollutant removal, to the extent that the permittee's discharges shall not cause or contribute to violations of water quality standards, as outlined below and by the design criteria identified in *State Regulation 72-307.C.(5).(a), 72-307.C.(5).(b) and 72-307.C.(5).(c)*, unless specifically exempted by *SC Regulation 72-302.A*.

- **Inlet Protection.** Inlet protection must be provided at all existing and newly installed inlets that receive Stormwater runoff from the disturbed areas.
- **Outlet Protection.** Outlet protection must be provided at all existing and newly installed outlets, within the construction site's boundary, that discharge stormwater runoff from the disturbed areas. Silt fence may not be used as outlet protection.
- **Sediment Basins.** For common drainage outfalls that serve an area with 10 or more disturbed acres, a sediment basin, or equivalent sediment control BMPs, which meets the criteria identified in *Appendix K* of the handbook must be provided where attainable until final stabilization of the construction site is achieved. For common drainage outfalls serving an area of less than 10 acres, sediment basins are still recommended where applicable. In addition the sediment basin must be designed to meet the following requirements:
 - When computing the number of acres draining into a common drainage outfall, it is not necessary to include flows from off-site areas and flows from on-site areas that are undisturbed or have undergone final stabilization, and have been diverted around both the disturbed area and the sediment basin.
 - In determining whether installing a sediment basin is attainable, the SWPPP Preparer may consider factors such as soils, slope, available area on-site, etc. If a sediment basin is determined to be not attainable, sediment traps or equivalent sediment control BMPs should be used (e.g., silt fences, vegetative buffer strips, rock check dams, rock sediment dikes, or a combination of these).
 - In any event, the SWPPP Preparer must consider public safety as a design factor for the sediment basin, and alternative sediment controls must be used where construction site limitations would preclude a safe design.
 - ENV may on a case-by-case or watershed-by-watershed basis require the use of a larger storm event and/or a larger storage volume when designing sediment basins or equivalent sediment control BMPs.



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- Unless infeasible, properly design, install and maintain porous baffles, or similar control measures capable of enhancing settling capabilities and restricting the accumulation of sediment around the outlet structure, in all temporary sediment traps and sediment basins to reduce velocity, turbulence, and improve sediment trapping efficiency.
 - Unless infeasible, sediment forebays, or similar control measures capable of providing sediment trapping at inlets of sediment basins, should be installed as practicable based on sediment storage requirements of each sediment basin.
 - Unless infeasible, each sediment basin must be equipped with a cleanout stake indicating when the basin is to be cleaned.
- **Sediment Traps.** For drainage outfalls serving greater than 2 acres but less than 5 acres, sediment traps, or equivalent sediment control BMPs, which meets the criteria identified in State Regulations 72-307.C, when applicable, must be provided where attainable until final stabilization of the construction site is achieved.
 - **Surface Withdrawal.** When discharging from sediment basins and similar impoundments, utilize outlet structures that only withdraw water from near the surface of the basin or impoundment, unless infeasible. This outlet structure should be capable of conveying the flow for the 10-year, 24 storm event.
 - **Trenches and Excavations Dewatering.** Permittees are required to minimize the discharge of pollutants from dewatering trenches and excavations. Pollutants from dewatering can be removed by the use of dewatering bags, vegetated filter strips or other BMPs approved by ENV.

3.2.1.6.6 Runoff Controls and Conveyance Measures

In addition to temporary measures, EPSC BMPs that control runoff should in addition to other BMPs listed in this Handbook provide the overall protection of downstream environments. Suggested varieties include pipe slope drains, protection at stream crossings, de-watering, level spreaders, subsurface drains, diversion dikes, and berms. Details on these and other EPSC BMPs can be found in *Appendix E*.

Each runoff control and conveyance measure BMP must be designed, installed and maintained to achieve maximum pollutant removal, to the extent that the permittee's discharges that shall not cause or contribute to violations of water quality standards, as outlined below and by the design criteria identified in *State Regulation 72-307*.

- **Permanent Conveyance Measures.** Each conveyance measure must be stabilized and capable of handling the 10-year 24-hour storm event with non-erosive flow conditions during construction and post-construction. If the velocity exceeds 5 ft/s, then permanent velocity



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dissipation measures, devices, and/or erosion prevention BMPs must be installed to provide non-erosive flow conditions.

- **Temporary Conveyance Channels.** Design channels to avoid disturbed areas and to reduce erosion. Divert concentrated flows of Stormwater running onto the site and within the construction site to avoid contact with soils exposed during construction, unless infeasible. Prevent erosion of channel embankments, outlets, adjacent streambanks, slopes and downstream waters during discharge conditions through the use of velocity dissipation devices (e.g., check dams, sediment traps, riprap, or grouted riprap at outlets) within and along the length of any constructed stormwater conveyance channel, and at any outlets to provide a non-erosive flow velocity.
- **Stabilization of Conveyance Channels.** Complete stabilization of stormwater conveyance channels (within 7 days of channel construction). Examples of vegetative and non-vegetative stabilization techniques include channel liners, rolled erosion control products (e.g., erosion control blankets and turf reinforcement mats), riprap, geotextiles, or other armoring materials that are suitable for use in areas with concentrated or channelized flow. Application of mulch, hydromulch, tackifier, or similar erosion prevention practices that are erodible, conveyable, or that obstruct flow when used in areas with concentrated or channelized flow in stormwater conveyance channels is prohibited.
- **Storm Drainage Systems.** No new point discharges onto adjacent property where there was not a point discharge previously, unless written permission from the adjacent property owner is provided. A twenty (20) foot minimum buffer should be provided, where feasible between the property line and the discharge point. Level spreaders, plunge pools, etc. shall be provided when the proposed outlet is near the property line and not directed to an existing outfall, such as a creek or ditch. All outlets from a storm sewer system shall not discharge on fill slopes.
- **Velocity Dissipation Devices.** Appropriate Velocity Dissipation devices and/or erosion prevention BMPs must be placed at discharge locations and along the length of any outfall channel to provide non-erosive flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected. Silt fence may not be used as an energy dissipater.

3.2.1.6.7 Permanent Vegetation

Permanent cover is required by the 14th day after work is complete. For final acceptance of permanent cover, the site must have a uniform perennial vegetative cover with a density of 70% of each square yard of the seeded areas. See the SCDOT Seeding Specification for more details. (*Appendix F* or at http://www.scdot.org/doing/stormwater_Erosion.aspx. Designer is responsible for using the most up-to-date version of the SCDOT Seeding Specification.

SCDOT divides the state into two zones used for selecting vegetation: upper and lower. Fort Jackson is located in Richland County which falls within SCDOT's "lower" zone.



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Choose a minimum of two (2) seed types from Table 1 in *Appendix F* for all permanent cover based on specific application and the availability of the seed. A minimum of one (1) seed type selected must be a turf-type species. The Contractor may add an acceptable permanent cover nurse crop from Table 2 in *Appendix F*.

A soil analysis must be conducted prior to all permanent cover operations, and used to determine the need and rate of lime and fertilizer. The soil analysis must be completed by a SCDOT certified laboratory. See *Appendix F* for more details.

3.2.1.7 Stormwater Drainage System Design

This section provides the design requirements for various storm sewer drainage/collection system components including: design storms, velocities; and, pipe and inlet sizes.

3.2.1.7.1 Design Requirements

Storm drainage systems shall include all storm drainage structures and pipes that do not convey runoff under roadways. These systems are commonly referred to as lateral closed systems.

The storm drainage systems shall be designed based upon the following criteria:

- 25- year 24-hour design storm event capacity for pipe design,
- 25- year 24-hour design storm event capacity for inlet structure design,
- 25- year 24-hour design storm event capacity for drainage channels,
- 50-year 24-hour design storm event capacity for sump inlets, unless overflow facilities are designed,
- 100-year 24-hour storm event shall be used to check all drainage designs using for local flooding, and possible flood hazards to adjacent structures and/or property.
- The Rational Method and SCS Method for peak runoff flow rates are acceptable techniques (see section 3.2.1.2.2) for limits on drainage areas),
- The minimum pipe size is 12 inches,
- Hydraulic grade line and head loss calculations for determining water surface elevations shall be performed for all systems with 10 or more connections,



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- calculations should be performed for the 25-year 24-hour design storm event,
 - for storm drainage systems with less than 10 connections, Manning's Equation shall be acceptable for sizing the capacity of drain pipes for non-submerged conditions where the free water surface elevation is below the crown of the pipes,
 - if the outlet is submerged in a backwater condition, a more sophisticated design methodology than Manning's Equation shall be required. Individual head losses in the pipe systems shall be calculated. These head losses are added to a known downstream water surface elevation to give a design water surface elevation for a given flow at a desired upstream location. Various accepted computer models are available for analysis of storm drain systems under backwater and/or pipe flow surcharge conditions,
 - storm drain profile plots should be included in the set of construction plans.
- Minimum design velocity for pipe flow shall be 2.5-feet/sec when pipes are one-third or more full,
 - Maximum design velocity shall be 20-feet/sec,
 - Minimum slope of storm drain systems shall be 0.5 percent,
 - Storm drainage systems shall be designed to convey stormwater runoff by gravity flow unless otherwise approved,
 - For very flat flow lines, flow velocities shall increase progressively throughout the system. Upper reaches of the pipe system may have flatter slopes than the lower end of the system. Progressively increasing slopes keep solids moving toward the outlet and inhibit the settling of particles,
 - All discharges should be to existing structures. Justification that discharge rates from proposed development does not adversely impact existing drainage features should be included as necessary,
 - Minimum fill cover on all pipes shall be 1-foot. The maximum cover shall be based on the design loads which are calculated from pipe shape, pipe size, pipe material and location,
 - Type and class of storm drainage pipe, as well as the construction of pipe culverts, shall be in accordance with the Unified Facilities Criteria. The proposed use of



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any type of storm drainage pipes other than reinforced concrete pipe (RCP) shall be specifically approved in writing by the Directorate of Public Works.

- The following design requirements shall be followed to compute the capacity of storm drain inlets and grates by applying appropriate weir, orifice, and pipe flow characteristics:
 - inlets shall be designed to convey the 10-year 24-hour storm event,
 - maximum depth in which the water may pond above or around an inlet must not threaten surrounding permanent structures or facilities including vehicular or pedestrian traffic,
 - inlets placed in sump conditions shall have emergency overflow points designed,
 - inlets placed in roadway gutter lines must be spaced to prevent flow from entering road intersections,
 - maximum spread of 6-feet in the travel lane.
 - valley gutter shall have a maximum allowable spread of 7-feet.
 - standard 2-feet 6-inch curb and gutter is allowed a total maximum spread of 8-feet from the face of the curb.

In depth design procedures for inlet and storm sewer design may be referenced in AASHTO (1999), Yen (2001).

3.2.1.8 Open Channel Hydraulics

Open channels shall include all permanent storm drainage channels including swales, culverts, and diversions. These storm drainage systems shall be designed based upon the following criteria:

- Channels shall be designed to carry the 25-year 24-hour design storm event.
- Major channels may be designed for greater storm frequencies if directed by Fort Jackson.
- Design conditions can be assumed to be steady, uniform flow.
- Minimum channel slope shall be 0.5 percent, unless supporting calculations show that there will be no pools or standing water areas formed in the channels at smaller slopes.



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- Except for roadside ditches, the side slopes of grassed lined channels without Erosion Control Blankets or Turf Reinforcement Matting shall be no steeper than 3H to 1V.
- Manning's Equation may be used to design open channels and swales where backwater effects created from obstructions and/or tailwater is not present.
- Channels may be designed with multiple stage levels with a low flow section to carry the 2-year storm event and a high flow section to carry storms of larger frequencies.
- Maximum flow velocities shall be determined based on the channel bottom material and bank slope material. Table 3-11 contains an expanded list of permissible velocities for various different types of channel vegetation and slopes.
- Fort Jackson allows vegetated channels. Guidance on the design of these type channels can be found in Haan et. al. (1995) or by using computer software that is capable of calculating for stability and capacity.
- Culvert design shall include all cross drainage facilities that transport stormwater runoff under roadways. Culvert selection techniques can range from solving empirical formulas, to using nomographs and charts, to comprehensive mathematical analysis for specific hydraulic conditions. The many hydraulic factors involved make precise evaluation time consuming and difficult without the help of computer programs and models. The actual models used for these calculations shall be at the discretion of the design professional with approval from Fort Jackson. Designs shall be based upon SCDOT requirements where applicable. The following criteria shall be followed:
 - All cross-drain culverts shall be designed to pass the 25-year 24-hour design storm event without overtopping the road.
 - All interior culverts shall be designed to pass the 10-year 24-hour design storm event without overtopping the road.
 - Additional hydraulic capacity shall be required as necessary to prevent backwater effects that may adversely impact upstream property or structures.
 - Acceptable models for designing culverts include, but are not limited to:
 - HY8
 - SEDCAD4
 - Pond Pack
 - HEC-RAS
 - Culvert Master



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Table 3-7: Maximum permissible velocities for vegetated channels

| Cover | Permissible Velocity (ft./sec.)* | | | | | |
|----------------------|------------------------------------|------|------|--------------------------------|------|------|
| | Erosion Resistant Soils % Slope | | | Easily Eroded Soils % Slope | | |
| | 0-5 | 5-10 | > 10 | 0-5 | 5-10 | > 10 |
| Bermuda Grass | 8 | 7 | 6 | 6 | 5 | 4 |
| Bahia | | | | | | |
| Buffalo Grass | | | | | | |
| Blue Gamma | | | | | | |
| Centipede Grass | 7 | 6 | 5 | 5 | 4 | 3 |
| Tall Fescue | | | | | | |
| Kentucky Bluegrass | | | | | | |
| Red Canary Grass | | | | | | |
| Grass-legume Mixture | 5 | 4 | NR | 4 | 3 | NR |
| Lespedeza Sericea | | | | | | |
| Weeping Lovegrass | | | | | | |
| Kudzu | | | | | | |
| Alfalfa | 3.5 | NR | NR | 2.5 | NR | NR |
| Small Grains | | | | | | |
| Temporary Vegetation | | | | | | |

* Allow velocities over 5 ft/sec only where good cover and maintenance will be provided. If poor vegetation exists due to shade, climate, soils or other factors, the permissible velocity shall be reduced by 50 percent.

NR = Not Recommended

Sources: Elementary Soil and Water Engineering, Shwab et. al. and Hann et. al. (1995)

3.2.1.9 100-Year Floodplain

The goal of this section of the Handbook is to provide an overview of the requirements and procedures for proposed land development occurring in the 100-year floodplain (floodplain). Development is defined as any manmade change to improved or unimproved property including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.

3.2.1.9.1 Floodplain Policy

The provisions in this section apply to all development in areas of special flood hazard identified by the Federal Insurance Administration in its Floodway Boundary Map and Flood Insurance



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Rate Maps Community #450079C, panels 0113G, 0115G, 0120G, 0150G, 0176G, 0177G, 0185G, dated January 19, 1994, panel 0110H, dated February 20, 2002, and any revisions thereto.

It is the purpose of this section to promote the public health, safety and general welfare and to minimize losses due to flood conditions in specific areas by provisions designed to:

- Restrict or prohibit uses that are dangerous to health, safety and property due to water or erosion in flood heights or velocities.
- Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging and other development which may increase erosion or flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

3.2.1.9.2 Floodplain Standards

The following is a general summary of the provisions of FEMA:

- Development within the limits of a floodplain can not cause an increase of the level of the base flood. If such increase is anticipated, then the applicant must submit an application for a Conditional Letter of Map Revision (CLOMR) to Fort Jackson and FEMA.
- If an adverse effect is determined, engineering justification by the use of hydraulic computer models and compensatory storage at hydraulically equivalent sites for the proposed development shall be required.
- No structures are allowed within the floodway or adopted regulatory floodplain in Unnumbered A Zones unless acceptable engineering justification is provided.
- There is a 1-foot freeboard requirement on all new construction and substantial improvements within the 100-year floodplain.
- All new construction or substantial improvements shall be constructed on properly designed and compacted fill (ASTM D-698 or equivalent) that extends beyond the building walls before dropping below the base flood elevation and has appropriate protection from erosion and scour. The design of the fill or the fill standard must be approved by a registered engineer or meet the engineered



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support requirements similar to those for V-Zones (as set out in 44 CFR 60.3 (e)(4)).

- All new and replacement water supply and sanitary sewer systems must be designed to minimize or eliminate infiltration into the system.

3.2.1.9.3 Floodplain Study General Criteria

All floodplain studies shall follow the guidelines and procedures as set forth by FEMA and Fort Jackson Fort Jackson. The general criteria and requirements have been established to help clarify the procedures related to performing a floodplain study in Fort Jackson are as follows:

- The project must be consistent with applicable State and Federal regulations,
- A professional engineer registered in the State of South Carolina shall prepare all studies,
- The following hydraulic computer models for floodplain development on Fort Jackson are recommended but are not limited to:
 - HEC-RAS and
 - WSPRO,
- The floodplain analysis shall include the 10-, 50-, 100-, and 500-year, 24-hour storm events,
- Hydrologic analyses should utilize the current land use conditions based on the most updated data within the desired watershed (FEMA only allows for consideration of existing conditions in the watershed; Fort Jackson can require particular models to be based on built-out conditions for its own purposes, but FEMA will not accept these future conditions in the FEMA submittal),
- Volume as well as peak flow shall be evaluated,
- Limits of the 100-year floodplain for the pre-development and post-development conditions shall be shown on the site plan,
- Backwater conditions, local obstructions, bridges, culverts, and stormwater conveyance systems shall be considered,
- Digital data shall have the following characteristics:
 - horizontal datum: NAD83 (1986),
 - coordinate system: UTM Zone 17,



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- vertical datum: NAVD88, and
- units: international feet,
- Data capture methods must result in new data meeting national horizontal and vertical accuracy standards, which are scale dependent. Horizontal accuracy standards are approximately (+/-) 2.5-feet, +/- 5.0-feet, and (+/-)10.0-feet, respectively for each mapping scale. Vertical accuracy is (+/-) one half of the contour interval for a given area.
- All proposed work within Unnumbered A zones must be accompanied by hydrologic and hydraulic modeling.
- Calculated flood boundaries shall be submitted in a digital format that is compatible with Fort Jackson's GIS data.

3.2.1.9.4 Floodplain Study Submittal Criteria

Each permit must include:

- Applicants name
- Location where the work will be done

A type of development must be chosen. If the work being done falls into "other", please elaborate in the comments section.

Under "Flood Zone" all properties that have floodplains must check either "No. A or A Zone". The No. A zones are floodplain areas that have had a detailed study performed and a base flood elevation is known. The base flood elevation in A zones have been approximated.

Under "Location in relation to Floodway/Floodplain", all properties that have floodplains must chose "inside adopted floodplain". In the comments section, if the work to be done includes a structure, make a note as to whether the structure is located within the floodplain.

The application must be signed and stamped by a South Carolina Registered Engineer, Surveyor, or other qualified Federal Government employees and the applicant must sign the application.

Hydrologic and hydraulic analyses must be contained in a report describing the study methodology, a listing of all assumptions (e.g., rationale for Manning's 'n' values, reasons for revising hydrology, source of topographic information and land use), bridge and cross section data, and a brief description of the project.

All projects being submitted to FEMA must have a completed FEMA MT-1 or MT-2 form as appropriate. These forms can be obtained from the following.



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FEMA website

www.fema.gov

FEMA Region IV

3003 Chamblee Tucker Road
Atlanta, Georgia 30341
(770.220.5400)

The South Carolina Department of Natural Resources

Flood Mitigation Program
2221 Devine Street, Suite 222
Columbia, South Carolina 29205
(803.734.9103)



4.0 INSPECTIONS & ENFORCEMENT

This chapter establishes inspection and enforcement guidelines to be followed by Fort Jackson.

4.1 Fort Jackson Stormwater Inspections

Fort Jackson will inspect applicable construction sites from initial land clearing to final stabilization. The purpose of these inspections will be to check for compliance with and ensure enforcement of Fort Jackson stormwater management plan approved by the Directorate of Public Works. Maintenance inspections will also be performed on stormwater management systems and facilities throughout their useful life. For each system or facility installed or retrofitted during an approved construction project, the applicant must have submitted a maintenance schedule or plan. Fort Jackson inspectors will be checking for adherence to this plan and any necessary changes that may arise after installation. Inspections are not to be construed as a relaxation of the requirements on owners/operators to conduct self-inspection in accordance with any applicable local, state or federal stormwater requirements.

4.1.1 Fort Jackson Stormwater Management Inspector Duties/Responsibilities

Fort Jackson's Stormwater Management Inspectors shall inspect and enforce the requirements of Fort Jackson Land Disturbance Handbook. The job duties/responsibilities of an Inspector shall include, but not be limited to, the following:

1. Conduct and document during construction site inspections to ensure compliance with the approved permit or stormwater management plan. Frequency of inspections will be determined by Public Works staff.
2. Ensure that the approved Fort Jackson permit or SWPPP, and the construction plans are on the project site and are properly being followed and implemented.
3. Conduct post-construction inspections to ensure that permanent maintenance is being performed in accordance with the maintenance schedules for the various stormwater management facilities in Fort Jackson's permit or approved stormwater management plan.
4. Provide the owner/operator of the project a written report within seven (7) days after every inspection during construction or post-construction site inspection.
5. Initiate enforcement orders through the enforcement office to the owner/operator when any portion of the work does not comply with the approved Fort Jackson permit and/or stormwater management plan or work is occurring without appropriate permitting. The enforcement process is detailed in Section 4.3.



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6. Perform an inspection upon the completion of the stormwater system to determine if the system is constructed in accordance with Fort Jackson's approved permit and/or, stormwater management plan.
7. Take action if the owner/operator fails to comply with Fort Jackson's approved permit or the approved stormwater management plan and an imminent hazard exists as a result. The inspector will address the situation and notify any applicable local, state and federal agencies.
8. Maintain accurate and comprehensive project inspection files ensuring relevant information is entered in the files to be maintained in the Directorate of Public Works.

4.1.2 Inspection Process and Procedures

The Directorate of Public Works or an authorized representative/designee (inspector) may enter upon all properties for regular inspections, periodic investigations, enforcement, and to effectuate the provisions of the Handbook. Upon refusal by any owner/operator or property owner to permit an inspector to enter upon the property or continue an inspection, the inspector shall terminate the inspection or confine the inspection to portions of the property to which no objection is raised.

4.2 Permittee Inspection Responsibilities

In accordance with any applicable local, state and federal stormwater requirements including, but not limited to, the NPDES Construction General Permit (CGP), owner/operators are responsible for conducting during construction and post-construction site inspections.

During construction, a site must be inspected once every seven (7) calendar days and inspections are recommended within 24 hours of the end of a storm event of 0.5 inches or greater.

The Owner/operator will, at a minimum, include the following in the inspection report:

1. Date and location of the site inspection.
2. Names, titles, and qualifications of the inspector.
3. Weather/Rainfall information for the period since the last inspection
4. Weather/Rainfall information at the time of the inspection.
5. Locations of discharges of sediment or other pollutants.
6. Locations of BMPs requiring maintenance or have failed.
7. Locations where additional BMPs are needed.
8. Any required corrective actions or on site modifications
9. Site name, operator name, and permit number
10. Verification that appropriate BMPs have been installed.



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11. Whether the approved Fort Jackson permit, stormwater management plan, SWPPP, and construction plans have been properly implemented and maintained.

A Construction Inspection Log must be added as an Appendix of the SWPPP, an inspection log template can be found in *Appendix R*.

Fort Jackson ENV or DHEC may require on a case by case basis that the Permittee submit a monthly report summarizing the inspections at the site and any associated maintenance activities. Post construction inspections are to be conducted as required by the maintenance plan for each BMP.

Inspections for sites two (2) acres or larger must be completed by either the preparer of the SWPPP or his designee or an individual who has been certified in the Construction Site Inspector Certification Course. Records of such inspections shall be kept for a minimum of five (5) years and must be made available to Fort Jackson upon Request.

4.3 Enforcement

Construction site inspectors will be in charge of determining whether there has been a violation of the Land Disturbance Handbook. The responsible entity will be warned and provided a chance to correct the problem. After a time period based on the specific case, the inspector will return to the site and if the problem has not been corrected, the issue is turned over to contracting office/officer. At Fort Jackson, this is either the Directorate of Contracting (DOC) or the US Army Corps of Engineers. These offices have the ability to withhold payments until the issue is resolved. This generally results in immediate action when used. If the contracting office fails to take action on the issue or the contractor does not respond, DPW will move up the chain of command, sending notifications to higher and higher command personnel within the US Army until the issue is resolved. Command positions will generally direct the contracting office to take action, but could choose more direct methods. Fort Jackson DPW will not issue fines, but those contractors that caused the problem can be removed from being considered for future projects by the contracting office.



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